

**REMEDIAL ACTION, 881 HILLSIDE, 881
PHASE IIB CONSTRUCTION
(COLLECTION AND DISCHARGE SYSTEM)**

TITLE II DESIGN DOCUMENT

PREPARED FOR

**EG & G ROCKY FLATS, INC
ROCKY FLATS PLANT**

JANUARY 1991

PREPARED BY

ENGINEERING-SCIENCE, INC

Denver Colorado

IN CONJUNCTION WITH

THE RALPH M PARSONS COMPANY

Pasadena California

ES ENGINEERING-SCIENCE

REVIEWED FOR CLASSIFICATION/UCM

By

L. K. L. 1/2/91

Date

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NOTICE

All drawings located at the end of the document

**TITLE II DESIGN DOCUMENT
FOR THE
PHASE IIB CONSTRUCTION
(COLLECTION AND DISCHARGE SYSTEM)
REMEDIAL ACTION 881 HILLSIDE, 881
ROCKY FLATS PLANT
GOLDEN, COLORADO**

Prepared for
EG&G ROCKY FLATS, INC

January 1991

Prepared by
Engineering Science Inc
1100 Stout Street, Suite 1100
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In Conjunction with
**THE RALPH M PARSONS COMPANY
PASADENA, CALIFORNIA**

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INTRODUCTION

01001 SCOPE

This Title II Report provides the plans and specifications for construction of facilities associated with Phase IIB Construction of the 881 Hillside Remedial Action. Phase IIB Construction of the project includes the following facilities:

Influent collection gallery, sumps, wells, pipeline, and electrical

Effluent discharge line and structure

Building 891 truck loading dock

Site cleanup, final grading, and landscaping

In order to meet an accelerated schedule for construction of the Remedial Action, the project has been divided into several phases of construction. Each phase of construction is briefly described as follows:

Phase IA Construction: Building 891 foundation

Phase IB Construction:

Erection of a pre-engineered Building 891

Erection of influent storage tanks

Construction of influent tank foundations and containment structures

Construction of water supply pipeline, sewer pipeline, natural gas service pipeline, electrical service, and telephone service to Building 891

Construction of Building 891 HVAC, plumbing, and electrical

Phase IIA Construction:

Process treatment system, including electrical and controls

Indoor and outdoor transfer piping

Tank electrical and controls

Chemical storage and transfer facilities

Completion of Building 891 electrical and outdoor lighting

Installation of treatment system and influent storage tanks

Phase IIB Construction

Influent collection gallery sumps wells pipeline and electrical

Effluent discharge line and structure

Building 891 truck loading dock

Site cleanup final grading and landscaping

In addition, the following facilities which are part of the 881 Hillside Remedial Action will be procured under separate contracts as Government Furnished Equipment

Pre engineered Building 891 to be erected during Phase IB construction

A UV/peroxide treatment system

An ion exchange treatment system

Four 15 000 gallon horizontal cylindrical influent storage tanks

Three 159 000 gallon effluent storage tanks and foundations to be designed and constructed as a separate contract

Phase IA and IB construction is currently underway Phase IIA Construction Specifications and Drawings have been submitted to EG&G Phase IIB construction is addressed herein

This report expands upon information developed in the Title I, Preliminary Design Basis Document for the 881 Remedial Action Plan June 1988 The scope of this Title II report covers the design development of contract drawings and specifications for Phase IIB of the project A detailed cost estimate is presented under separate cover

01002 PURPOSE OF PROJECT

The primary objective of the Building 881 Hillside Remedial Action Plan (Project) is to collect contaminated ground water from the 881 Hillside and treat it to acceptable levels for surface discharge A conceptual design for the project has been developed as a result of Remedial Investigation/Feasibility Study (RI/FS) procedures A Health Risk Assessment performed in conjunction with the RI/FS concluded that a small identifiable health risk to the public would occur in the future if no remedial action was performed at the site Implementation of the recommended remedial action will eliminate the future risk and

result in the removal of the contaminants identified as contributing to the risk

Preliminary process design and selection for volatile organics removal was performed as a part of the RI/FS and subsequently verified through independent treatability studies initiated by Rockwell International as operators of Rocky Flats Plant and performed by a manufacturer of the selected system. The selected process for treatment of the volatile organics is an ultraviolet light (UV)/hydrogen peroxide (H2O2) system and is discussed in detail in the referenced RI/FS. In addition, Rockwell subsequently directed that the treatment plant be expanded to include ion exchange for metals and radioactive contaminant removal.

The Title I report included preliminary design of a ground water collection system, sumps and sump pumps, installation of a collection well, influent piping, modification of existing Building 830 (subsequently deleted from the project) to accommodate the treatment unit, erection of influent storage tanks and an effluent re-injection system.

This Phase IIB Title II report completes the design of the Phase IIB facilities and presents drawings and specifications suitable for bidding by qualified contractors.

01003 LOCATION OF WORK

The location of this work is the 881 Hillside area and is shown on the Area Plot Plan in the Drawings. This area lies immediately south and east of the Building 881 near the perimeter of the plant site. The collection gallery extends from a location south of Building 854 and along the South Interceptor Ditch to a location approximately 2,000 feet east. The influent and effluent pipelines will extend from the collection gallery to Building 891. The collection well will be located approximately 1,000 feet east of Building 881. The outfall of the Building 881 footing drain is located just south of Building 881. The truck loading dock will be located adjacent to Building 891.

01004 DESIGN CRITERIA

The Title II Design Document for Phase IIB construction conforms to all preliminary requirements as stated in the Preliminary Design Basis Document, June 1988, the RI/FS Volume I, March 1988, and the Design Criteria for Remedial Action 881 Hillside, Volume 3, May 1988. Several subsequent modifications to the preliminary design were made due to regulatory agency requirements and during further design of facilities. The Basis of Design Report for Ion Exchange System, December 1989, the Phase IIB Title II Design Document, the Phase IIA Title II document, and this Phase IIB Title II document incorporate these changes. The design information contained in this document is intended to meet the

requirements of the Design Criteria Manual for the Rocky Flats Plant (Vol 1 and 2)

01005 WORK INCLUDED

Work covered in this Phase IIB Title II Document includes

Construction of a ground water collection gallery with associated drain pipe sumps and pumps

Installation of influent piping from collection points to the Building 891 process treatment system

Installation and development of a ground water collection well

Construction of a collection system for water from the Building 881 foundation drain

Installation of effluent piping from Building 891 to a surface water discharge location

Construction of a truck loading dock and door aprons adjacent to Building 891

Installation of collection/delivery instrumentation and controls

Installation of electric power hookup and control center for Phase IIB equipment

Final site grading landscaping gravel driveways and parking areas, and site cleanup

01006 REGULATORY COMPLIANCE

The contract specifications for construction are consistent with Federal Statutes, Regulations and Interpretative Rules, and specifically reference the Contractor's responsibilities to participate in components of the Remedial Action Process as described in Superfund Remedial Design and Remedial Action Guidance OSWER Directive 9355 0 4A June 1986 Upon completion of construction the Contractor shall be required to participate in required activities including the Prefinal Construction Conference the Prefinal Inspection and Final Inspection and Certification

The Buyer will provide a full time on site inspector with expertise in federal construction projects and proceedings

BASIS FOR DESIGN

01007 GENERAL

A Design Documents

The documents listed below form the basis for the Facilities Engineering design of the Building 881 Remedial Action Plan

- 1 Design Criteria Manual Volumes 1 and 2 Rocky Flats Plant
- 2 Design Criteria for Remedial Action 881 Hillside Rocky Flats Plant Volume 3
- 3 Feasibility Study Report for High Priority Sites (881 Hillside Area) Volume I
- 4 Preliminary Design Basis Document for the 881 Hillside Remedial Action Engineering Science Inc
- 5 Rocky Flats Plant Standards Manual Volumes I II and III
- 6 Basis of Design Report for Ion Exchange System 881 Hillside Remedial Action Engineering Science Inc
- 7 French Drain Geotechnical Investigation Volumes 1 2 and 3
- 8 Specification and Drawings for Phase IA Construction 881 Hillside Remedial Action, Engineering Science Inc
- 9 Title II Document for Phase II (IB) Construction 881 Hillside Remedial Action Engineering Science Inc
- 10 Specification and Drawings for Phase II (IB) Construction 881 Hillside Remedial Action Engineering Science Inc
- 11 Title II Document for Phase IIA 881 Hillside Remedial Action Engineering Science Inc
- 12 Specification and Drawings for Phase IIA Construction 881 Hillside Remedial Action Engineering Science Inc

B Quality Assurance

This design incorporates applicable regulatory requirements and design basis for structures modifications additions systems and components such that they are correctly translated into specifications drawings procedures and

Instructions The following are those attributes included in the design

- 1 Facilitate inspectability of equipment during fabrication shipping construction and testing
- 2 Performance and acceptance criteria
- 3 Accommodations for equipment handling protection storage and shipping
- 4 Optimization of maintainability/serviceability of facilities
- 5 Specify material requirements including such items as compatibility protective coating and corrosion resistance
- 6 Material traceability through drawing and/or specification callouts and
- 7 Personnel safety and protection of economic investment

The Quality Acceptance Criteria Checklist is included in Section 5 of this Title II document

C Design Requirements/Codes and Standards

All facilities are designed and sized for the site elevation of approximately 6 000 feet above mean sea level

The facilities have been designed with regard to the following codes and standards as they apply

- 1 ACI American Concrete Institute
- 2 AISC American Institute of Steel Construction
- 3 ANSI American National Standards Institute
- 4 ASTM American Society for Testing and Materials
- 5 AWS American Welding Society
- 6 AWWA American Water Works Association
- 7 IEEE Institute of Electrical and Electronics Engineers
- 8 IPCEA Insulated Power Cable Engineers Association
- 9 ISA Instrument Society of America

- 10 NEC National Electric Code
- 11 NEMA National Electrical Manufacturers Assoc
- 12 OSHA Occupational Safety & Health Act of 1970
- 13 UBC Uniform Building Code
- 14 UPC Uniform Plumbing Code
- 15 U/L Underwriters Laboratory

D Special Considerations

- 1 Contamination Control All excavated materials shall be handled in such a manner to minimize contaminant dispersion via aeolian dispersion or leaching. Excavated material is to be placed as surface fill in an area specified by the Buyer. The Contractor will be required to submit a Dust Control Plan for all construction activities. Prior to excavation soils will be wetted to a moisture content exceeding optimum moisture as defined by Standard Proctor Compaction Testing, ASTM D 698. In general during handling the excavated materials will be thoroughly wetted but will not contain moisture to the extent which would interfere with the Contractor's handling equipment. Excavated materials in stockpiles will be immediately stabilized by covering or other approved means immediately upon conclusion of work at that particular stockpile. During final placement of waste excavated material the surface will be stabilized by compaction and such covering as may be necessary so that aeolian dispersion is minimized. No earthwork will be permitted during periods in which the wind velocity exceeds 15 mph. Long term erosion protection will be provided by seeding and irrigation as required or other means approved by the Buyer. Irrigation will not begin until after the collection system and treatment unit are functional. Earthwork operations will be planned and conducted in a manner to promote maximum handling efficiency. Materials will be immediately placed and compacted after initial excavation where practicable.

The influent piping shall be constructed of double wall polypropylene to provide secondary containment of contaminated water between the collection gallery and Building 891. A leak detection system will be installed to monitor the integrity of the influent pipeline.

Any excavated materials as determined by the Buyer's Health Physics representative (Radiation Monitor)

exceeding the criteria for placement as fill will be immediately segregated from other uncontaminated materials and placed in containers provided by the Buyer. The Buyer shall arrange for removal and disposal of these containers.

The Contractor shall make every effort to minimize the amount of water generated during construction dewatering operations. During dewatering and excavation of the collection gallery trench the Contractor will be responsible for pumping the water to a tank, tanker truck, trailer or carboy provided by the Buyer. Subsequent disposition of the water will be the responsibility of the Buyer.

2. **Safety Requirements.** The Contractor is instructed to conform to Chapter 1 of DOE Order 5480.1, Environmental Protection, Safety and Health Protection Standards, and National Fire Protection Association (NFPA) No. 241, Safeguarding Building Construction and Demolition Operations. All visitors and construction personnel are required to adhere to all regulations and receive indoctrinations which pertain to them.

3. **Safeguards and Security.** Construction of these facilities will be performed in compliance with the established Rocky Flats Plant Security Program. The project is not located in a secured area.

The Contractor will obtain an approved Land Use Request for access control prior to entry into the buffer zone in accordance with HSE 20.01.

4. **Health, Safety and Environment.** The Contractor is required to adhere to the procedures established in the Rocky Flats Plant Health, Safety and Environment (HS&E) Manual and the Plant Policy Manual where applicable. In particular, the Contractor is required to adhere to Plant Policy HMS 3.050 which requires that all personnel allowed on the plant site participate in applicable radiation exposure measurement programs. All personnel working on the project are required to be fully briefed on HS&E rules and regulations that must be followed on the project and are required to attend all applicable safety training indoctrinations.

The Specifications explicitly reference appropriate worker health and safety standards.

The Contractor shall prepare a site health and safety plan in accordance with HSE 24.01.

A full time Radiation Monitor will be provided by the Buyer during all excavation

- 5 Operation Interruptions The Contractor is required to perform all service and utility disconnects and tie ins during normal working hours as practicable The Contractor is required to schedule disconnects and tie ins to minimize downtime and interruptions to other facilities and is required to schedule all work with the Buyer prior to the start of work

01008 PROCESS DESIGN

Much of the process design for the project has been performed as part of Phase IIA

The treatment process has previously been selected as UV/Hydrogen Peroxide for the destruction of volatile organics contained in the contaminated ground water In addition ion exchange treatment has been added to the process train for removal of metals This Phase IIB design includes the collection and transfer system for the input of contaminated ground water into the treatment system in Building 891

01009 CIVIL DESIGN

A General

The civil engineering design encompassed the construction of the collection gallery system the effluent discharge a collection well interconnecting pipelines and a truck loading dock in addition to minor earthwork at the site The following sections provide clarification of these items

Finished grades will be as close as practicable to the existing

All buried pipes and utilities shall be protected from future mechanical damage by buried warning tapes

Final plans and specifications require the installation of physical surface monuments at significant points along all buried structures They shall include end points points of curvature tangent points and the location of branches

Final plans and specifications include compaction specifications for all fill materials including waste fill drain rock pipe bedding and filters

All surfaces within the required excavation limits will be cleared and grubbed The top 12 of soil will be stripped and stockpiled uphill of the proposed collection gallery in an area not proposed for fill placement This topsoil shall

be used for reclamation of surface areas above the excavations

B Collection Gallery

The collection gallery shall be excavated so that it penetrates at least 2 feet of continuous (uninterrupted by permeable members) claystone bedrock. Only impermeable bedrock members encountered in previous geotechnical investigations have been considered in determination of the design depth. The construction of the collection gallery will require excavation of a trench with 40° (from horizontal) sideslopes, as directed in French Drain Geotechnical Investigation (October 1990). The downgradient face of the trench and exposed bedrock surfaces shall be lined with an impermeable synthetic membrane. The impermeable membrane shall be designed to prevent communication between exposed bedrock members and to limit flow beyond the collection gallery under all circumstances. Grouting of bedrock surfaces shall be performed if it is determined during construction that faults or excessive fractures exist in the bedrock members. During operation of the collection gallery ground water will be collected in a layer of washed gravel with a 6 inch diameter perforated drainpipe near the bottom. The drainpipe and upstream face of the drain shall be protected with a geotextile filter as appropriate. Collection sumps are located at the low points of the drain. The design depth of the sumps was selected to provide sufficient storage to produce pumping cycles compatible with the mechanical equipment selected.

C Collection Well

The collection well will be approximately 20 feet deep. The well hole will be logged during drilling by an experienced engineering geologist or geotechnical engineer to document the lithology. The well will be at least 36 inches in diameter to impermeable bedrock and 16 inches in diameter for an additional 5 feet. It will be cased for its full length with 12 inch diameter stainless steel well casing, capped at the bottom and provided with surface seals and completion details. The well will have a screened interval extending between the bottom of the pitless adaptor and the bedrock surface. The well will be grouted for its entire length below top of bedrock with neat cement grout containing additives to prevent shrinkage.

D Collection Sumps

Collection sumps are located on the collection gallery system and the Building 881 foundation footing drain system. The collection gallery sumps will be excavated from bedrock and lined with impermeable membrane liner. The Building 881

foundation footing drain sump will be constructed of reinforced concrete and will redirect flow of water from the foundation footing drain outfall to the collection gallery by means of a buried pipeline

E Influent and Effluent Piping

Underground influent pipelines will be constructed to convey ground water from the collection sumps and the collection well to the treatment system in Building 891. Influent pipelines have been designed to provide secondary containment and leak detection. Treated effluent from Building 891 will be conveyed by underground piping to a location downhill and downgradient from the collection gallery for discharge into the South Interceptor Ditch. A discharge structure will be constructed to prevent excessive erosion from the point of discharge.

F Truck Loading Dock

A concrete pad will be constructed adjacent to Building 891 for truck parking during delivery of treatment chemicals or loading of secondary wastes for removal. The truck pad has been designed for temporary containment of liquids in the event of a spill or leak during unloading, with a holding capacity equivalent to the volume of a tanker truck plus 10 percent for rainfall.

01010 MECHANICAL DESIGN

A General

Mechanical construction for this Phase IIB package consists of installation of pumps in the collection gallery sumps.

B Pumps

Two submersible pumps will be installed in each of two sumps in the collection gallery for transfer of contaminated water to the treatment system. The pumps will be controlled from the treatment unit control panel and set so that one pump functions as a lag pump. The collection well will be equipped with one submersible pump.

01011 PIPING VALVES AND FITTINGS

A General

The influent collection gallery influent piping from the sumps to the influent storage tanks and discharge piping will be designed and constructed as part of this Phase IIB package.

B Piping Materials

Drain pipe within the collection gallery is constructed of perforated polyvinyl chloride. Influent piping from the collection gallery foundation sump and collection well to the influent tanks is constructed of double wall polypropylene. Effluent piping is constructed of CPVC. All outdoor above grade piping will be heat traced and insulated to prevent freezing.

C Pipe Identification

All piping systems associated with this construction package will be marked, painted and identified according to Rocky Flats Plant Standard No. SP 303, Standard for Identification of Piping Systems.

01012 ELECTRICAL

A General

The electric power supply and Building 891 electrical systems were previously designed as part of Phase IB of the project, including indoor and outdoor lighting, heater and exhaust fans, outlets, control panels and transformers. Electrical systems and controls for process equipment and tanks were provided as part of the Phase IIA package. Electrical systems and controls for remote sumps and wells outside the immediate area of Building 891 are provided in this Phase IIB package.

B Motors

All motors will be rated at 6,000 feet above mean sea level and will be provided with an insulation Class B or F. Motors will have a minimum rated service factor of 1.15 and will be selected based upon intended use and type of service. All bearings on motors larger than 1 HP will have a B10 rating of 5 years or 20,000 hours, whichever comes first. Motors smaller than 1 HP will be furnished with lubricated for life bearings. Motors used with pumps will be provided as an integral assembly with the pump under a single supplier responsibility. Compatibility of pumps and motors will be the responsibility of the single supplier.

C Grounding

A grounding conductor will be pulled through all conduits per Rocky Flats Standard SE 103, Electrical Wiring. The treatment system is grounded to the Building 891 grounding system in Phase IIA of the project. A separate grounding system for the effluent storage tanks has been provided. All field panels are provided with individual ground rods.

D Wiring and Identification

Wiring will be in accordance with Rocky Flats Standard SE 103 "Electrical Wiring". Electrical systems will be identified in accordance with Rocky Flats Standard SE 104 Identification of Electrical Systems. Wire markers will be provided at the ends and intermediate pull boxes and junction boxes of each single conductor, multiconductor cable jacket and each individual conductor, shielded cable jacket, and multicable jacket and each individual cable.

01013 ALARMS AND INSTRUMENTATION

A General

Instruments are industrial grade equipment from established manufacturers. State of the art type instruments are provided. Selection of instruments was based on maintainability, provisions for field calibration, flexible operating characteristics, and materials of construction.

In general, high level alarms are provided on all tanks, and malfunction alarms are provided for all pumps.

Instrumentation and controls for the entire treatment plant, treatment equipment, Building 891, and influent and effluent tanks have been provided in previous phases of construction of this project. Instrumentation and controls for collection gallery sumps No. 1 and 2, the collection well, and the influent pipeline leak detection system will be provided as part of this Phase IIB package. A description of the entire plant instrumentation system follows.

B Treatment Plant Control Panel UCP 1

The process treatment system is provided with a Unit Control Panel which provides complete system monitoring and unit status indication. The overall system has three Unit Control Panels:

| | |
|-------|-----------------------------|
| UCP 1 | Overall System |
| UCP 2 | UV/Peroxidation System (UV) |
| UCP 3 | Ion Exchange System (IX) |

UCP 1 enables or disables the UV and/or IX systems based upon influent and effluent tank conditions and associated valving. Influent flow rates are also monitored to insure pump operation.

UCP 1 analyses the operator selected pumping path from beginning to end of a given cycle (i.e., influent tank filling from the well and/or French drains, UV cycle, and

the IX cycle) The appropriate cycle will be disabled in the event a condition is not met

UCP 1 imposes total control on the clean water tank automatic valve In the event of high level the automatic valve will close diverting all of the IX effluent to the effluent tanks

UCP 1 also receives signals from the UV controller (UCP 2) and the IX controller (UCP 3)

C UV/Peroxidation Unit Control Panel UCP 2

The UV feed pumps are controlled by UCP 1 while the UV system is monitored and controlled by UCP 2 An on/off/auto switch is located on UCP 2 In the auto position, control is imposed by UCP 1 This control is limited to enabling or disabling the UV system based upon input relieved from components before and after the UV system

When the UV system is enabled operational monitoring and control is imposed by UCP 2 UCP 2 will enable or disable the UV system based upon the system status The following are disabling conditions

- High temperature
- High pressure
- Moisture in lamp enclosure
- H2O2 metering pump failure
- H2O2 low level
- Inoperative lamp or lamps

In one or more of the above events UCP 2 will shut down the UV system and send a signal to UCP 1 indicating shut down and cause UCP 1 will sound an alarm and indicate UV system failure

D Ion Exchange Unit Control Panel UCP 3

The IX system is a partially automatic system controlled and monitored by UCP 3 UCP 3 will impose total control over the system during each cycle However, each cycle is operator initiated An on/off/auto switch is located on UCP 3 In the auto position UCP 3 will operate the IX system and send signals indicating system status In the event a disabling condition arises UCP 3 will shut down the IX system and send a signal to UCP 1 indicating shut down and cause The following are disabling conditions

- High pressure
- End of cycle
- Pump failure
- Blower failure

When UCP-1 receives a disabled signal UCP 1 will sound an alarm and indicate IX system failure

E Building 891 Control Panel MCC 1

The main control center for Building 891 will include a main power switch and switches for UCP 1 and UCP 2 in addition to switches for the transfer pumps office unit heater and fan motor and Building 891 sump pumps

F Sump Pump Control Panels

Each collection sump pump will be equipped with an above ground control panel with an on/off/auto switch Also included in the remote control panel will be the flow totalizer Collection sump pumps will be configured to be selectable between active and standby The active pump will be controlled by level sensors with a low water shutoff and a high water on The control panel will be housed in a NEMA 3R weather tight enclosure

G Collection Well Control Panel

The control panel for the collection well will be similar to that described for the sump pumps except that only one submersible pump will be installed and hence no active/standby switching is necessary Pump operation will be controlled by a low water shut off and a high water on probe installed in the well casing

H Building 891 Sump Pumps

The sump in Building 891 will be controlled similar to the sump pumps described above except that the control panel will be mounted in conjunction with MCC 1 in Building 891 and no flow indication will be provided

I Tank Level Indication and Pump Alarm Panel MCP 1

The two influent storage tanks will be equipped with both high and low water level probes The probes will provide a high and low water signal to MCP 1 and UCP 1 respectively and depending upon which tank is selected at UCP 1 will provide a low water signal at UCP 1 or a high water (alarm) signal at MCP 1 The effluent tanks will be equipped with a high water probe to be connected to UCP 1 and MCP 1 and will provide a high effluent level alarm and signal equipment shutdown Additionally a conductive strip level element and level indicator will be provided for each tank with the indicators mounted on MCP 1 Sump and well pump malfunction will be sent via buried cable to MCP 1 with indicators signaling the location of the alarm All alarm signals will activate an automatic rotary type telephone dialer to alert

the appropriate personnel of the alarm condition. An ion exchange surge tank and a clean water storage tank are also included and have the same control features.

END OF SECTION 01000

01000 16

SECTION 01100
SPECIAL CONTRACT REQUIREMENTS

01101 LOCATION OF WORK

The work covered by this contract will be performed at the Rocky Flats Plant near Golden Colorado (See Location Map and Area Plot Plan the end of Section 01500) This facility is one which is owned by the Government and operated on behalf of the DOE by EG&G Rocky Flats Inc

01102 SCOPE OF WORK PERFORMANCE OF WORK BY CONTRACTOR

This contract covers the furnishing of all plant labor equipment supplies and materials and performing all work in strict accordance with the terms of the contract

Phase IIB Construction of the 881 Hillside Remedial Action project includes the following facilities

Influent collection gallery sumps wells pipeline and electrical

Effluent discharge line and structure

Truck loading dock

Final grading and landscaping

The contractor shall perform on the site and with his own employees work equivalent to at least 15% of the total dollar amount of work to be performed under the contract, not including the cost of materials If during the progress of the work hereunder the Contractor requests a reduction in such percentage and the Buyer determines that it would be to the Buyer's advantage he may in writing, authorize a reduction

01103 CONTRACT DRAWINGS AND SPECIFICATIONS

The Contractor will be furnished without charge 10 sets of specifications and half sized drawing and one full size set of reproducibles The drawings which constitute a part of the contract documents are as indexed at the end of these specifications

The Contractor shall observe and so caution any Sub contractor that the scales on the half sized drawings are not necessarily correct and may not be directly usable for material take offs

01104 ABBREVIATIONS

Abbreviations of organizations societies associations standards publications terms etc in various sections of the specifications are referenced in the individual sections

01105 SECURITY MEASURES

- a The Contractor shall furnish to the Buyer a letter listing all contractor organizations any deviations from the normal workday or workweek at the Rocky Flats Plant The contractor shall fill out a gate pass form (RF 34660) furnished by the Buyer for all Contractor and Subcontractor personnel requiring access to specified construction areas Access will be granted for the period of performance of work The Buyer shall be notified of the termination of employment of individuals submitted for access The Buyer reserves the right to exclude from the worksite any employee as deemed appropriate Access to the plantsite will not be granted to persons who are not citizens of the United States of America
- 1 When the duration of construction is 30 days or less, the Buyer shall issue each Contractor individual nonpicture security badges (passes) and parking permits for access to the plant These badges and parking permits are accountable property of the U S Government and shall be returned to the designated gate at the end of each day
 - 2 When the duration of construction is 30 days or more the Buyer shall issue each Contractor individual picture security badges (passes) and parking permits for access to the plant These badges and parking permits are accountable property of the U S Government and shall be returned upon the completion of the project
 - 3 The failure of the Contractor to return all badges and parking permits could result in a delay of contract closing and the withholding of \$500 from the final payment for each missing badge and parking pass
 - 4 The Buyer s subcontract Administrator shall be notified immediately of any missing or lost badges and parking permits
 - 5 The Buyer s Plant Protection Department will immediately report to the Buyer s Subcontractor Administrator any individual nonpicture security badge and parking permit not returned to the designated gate at the end of the day

01106 HEALTH SCIENCES MEASURES

- a All work under this contract will be performed in areas subject to Rocky Flats Health Safety & Environment rules and regulations as specified below

All persons requiring access to these areas will be subjected to lectures and administrative actions which are estimated to take approximately 16 hr per man. All costs for the time involved as a result of these actions shall be borne by the Contractor whether it involves more or less time than that estimated above

- b Reimbursement for Equipment Retained by the Buyer

- 1 Tools and equipment shall be monitored prior to being removed from construction areas
- 2 Any tools or equipment which are determined by the Buyer to be unsuitable for future use after having been monitored by the Buyer's Radiation Monitoring personnel will be retained by the disposition made by the Buyer
- 3 Reasonable compensation will be made for any tools or equipment which are retained by the Buyer. The Contractor shall immediately notify the Buyer in writing of the value which he places on the tools and/or equipment and the basis for such valuation

- c Specific Requirements

- 1 Protective clothing required for Contractor's nonworking supervisory personnel entering areas for short periods will be shoe covers respirators safety glasses smocks and dosimetry badges
- 2 All persons required to wear protective clothing will be required to take a shower at the close of each work day in shower facilities provided by the Buyer. Towels and lockers will be furnished by the Buyer
- 3 Food beverages and tobacco are not permitted in the construction areas of this project
- 4 Radiation Monitoring coverage will be provided by the Buyer on an as required basis except that a radiation monitor will be present during all demolition or removal operations

- 5 The Buyer will furnish lockable boxes to the construction site for the disposal of materials that are determined to emit radionuclides. The Contractor shall place materials so designated in these boxes. Waste boxes will be kept locked and stored inside buildings.
- 6 No pregnant females shall be permitted in radiation controlled areas.
- 7 A continuously recording anemometer with high level audible alarm and warning light set at 15 mph will be required during excavation activities.
- 8 Contamination Health and Safety Requirements

- a Occupational Medical Examination

Prior to work on the site all personnel must have a physical for hazardous waste workers which meets the requirements as addressed in SARA and OSHA. The physical examination must have been in the last 12 months and included a medical screening for the use of respiratory protective devices. In addition all workers will be required to have heavy metals blood and urine screening. Frequency of the screening will be prior to start of work, yearly at the request of the Buyer, and at end of the job. The Contractor shall provide to the Buyer a signed statement from the physician certifying that the employee has had the required medical examination and is fit for hazardous waste site work prior to work on the site. The statement shall include any work restrictions required by the physician.

- b Work Clothing

Adequate dress for personnel on the site shall consist of the following:

- 1 Full length trousers/slacks/jeans
- 2 Sturdy work shoes or boots, footwear meeting the requirements of ANSI Standards Z41 where heavy objects must be worked with or lifted

- 3 Shirts that cover the shoulders with sleeves at least T shirt length Tank tops shirts cut off at the midriff cutoff pants moon boots sandals sneakers and jogging shoes are considered unacceptable dress and will not be permitted at any Buyer controlled work site
- 4 Hard hats that meet the requirements of ANSI Standard Z 89 1
- 5 Safety glasses with side shields that comply with requirements of ANSI Standard Z 87 1

c Access Control Points

- 1 Access to controlled areas shall be controlled through a designated Access Control point Workers leaving the controlled area shall be monitored for contamination under the direct supervision of the on site Radiological Protection Technologist Workers shall decontaminate their work clothes and/or wash their faces and hands if necessary as directed by the appropriate Health and Safety Representative of the Buyer
- 2 Emergency phone numbers route to site medical facilities and the OSHA poster shall be prominently posted at the Access Control Point by the Contractor
- 3 If decontamination of clothing does not adequately remove contaminated material the Buyer will provide the wearer with a clean pair of coveralls and will have the contaminated clothing cleaned In the event that the clothing cannot be satisfactorily cleaned the Buyer will reimburse the Contractor for the value of the item if the worker was in compliance with contamination control requirement for the site at the time of the incident

9 Dust Control Plan

The Contractor shall submit a Dust Control Plan to the Buyer for approval which states the Contractor's methods for control of fugitive dust during construction Fugitive dust shall be controlled by several methods which may include

Watering for general construction and trench construction

Air and weather monitoring which result in work stoppage under certain environmental conditions,

Surface additives for temporary roads and staging areas

Windscreens for high wind areas and

Siting of staging areas and high traffic areas out of wind

The Contractor shall use the Construction Dust Suppression Feasibility Study for Remedial Action 881 Hillside for guidance in developing his Dust Control Plan

01107 PLAN OF OPERATIONS

There will be no stipulated sequence of construction. The Contractor shall arrange his schedule such that when work is started work will proceed promptly and vigorously to completion. The Buyer may require the Contractor to show satisfactory proof that materials, equipment, workers, etc. are or will be available as required to complete the work without undue delay. Normal working hours for Contractor shall be 8:00 a.m. to 4:30 p.m. unless otherwise noted.

01108 QUALIFICATIONS FOR FIRE PROTECTION SYSTEM INSTALLERS

The fire protection system shall be installed by a recognized fire sprinkler company which has been regularly engaged in the design and installation of systems of similar kind and scope as that required herein. The sprinkler system shall be designed by a N I C E T (National Institute of Certification of Engineering Technology) certified designer, level III or higher. In lieu of the NICET rating, the system will be designed under the direction of a licensed professional engineer. No subcontract for the fire protection system shall be awarded without the prior written approval of the Buyer.

Such approval will be given upon a showing that the proposed Subcontractor meets the above stated qualifications.

01109 HEALTH AND SAFETY

In addition to the requirements of Special Provisions No. 3 and GP 56, the following safety items will be emphasized and enforced:

a Ladders

- 1 No three legged ladders will be allowed
- 2 No wooden ladders will be allowed in any building
- 3 Aluminum ladders will not be allowed for work in areas where there is electrical power equipment or in Building 891
- 4 Industrial fiberglass ladders will be allowed

b All contractors shall comply with NFPA 241 (Safeguarding Building Construction and Demolition Operations)

c All workmen will be required to wear hard hats All visitors to posted construction areas will be required to wear hard hats

d All compaction performed with vibratory equipment will be performed by workmen wearing approved foot protection devices

e All Contractor personnel will wear shirts long pants and shoes on the plantsite

f A lift device known as the Xtraman Hoist or any lifting devices where by design the operator or any other person is used as the ballast or counterweight of the device is not to be used on construction projects at the Rocky Flats Plant

g Smoking restriction shall be as posted

h Safety meetings shall be held weekly

01110 MEDICAL RADIOISOTOPE PROCEDURES ON CONTRACTOR PERSONNEL

All persons engaged in construction at the Rocky Flats Plant are required to report any diagnostic or therapeutic treatment with radioisotopes to the Buyer Personnel should report prior to treatment if possible or immediately after such treatment when they return to work

01111 ROOF PROTECTION

Personnel requiring access to the roofs of various buildings shall comply with the following requirements

a Temporary walkways will be installed to and around any work areas

b Material will not be set on the roof surface unless suitable protection is provided for the roof surface

- c All scrap and excess material must be removed daily when the work or exercise is complete

01112 PRIVATELY OWNED RADIO PAGERS

Security regulations do not allow the use of privately owned radio pagers at the rocky Flats Plant except in areas designated as controlled such as the warehouse maintenance shops, garage etc Pagers must also be left in privately owned vehicles when entering any area that is not a controlled area

01113 HOLIDAY WORK CURTAILMENT

During the holiday periods covering the days April 13 1990 May 28, 1990, July 4 1990 September 3 1990 November 22 1990 through November 23 1990 and from December 25 1990 through January 1 1991 Construction Contractor activities will be suspended Contractors and their Subcontractors shall plan their work accordingly Access to the plantsite during these time periods will be by special arrangement with the Buyer only

01114 USE OF FIRE RETARDANT MATERIALS

The Contractor shall use fire retardant materials in construction which are specified in applicable divisions of Technical Provisions

END OF SECTION 01100

SECTION 01300
SUBMITTALS

01301 GENERAL (Refer to GP 59)

- a Descriptive submittals shall be made for all items of equipment set forth in the tables at the end of this section or such other items as may be identified during the design phase of the Contract. Submittals marked with an asterisk must be in reproducible form the same size and scale as the Contract drawings, or as directed. The Contractor shall submit eight complete sets for each submittal item, except fire equipment items which will require ten complete sets.
- b Omissions of items from the submittal table does not relieve the Contractor from the responsibility for submitting vendor data for any other applicable items that would normally require such submittals. The most closely related item listed will govern the type of submittals required.
- c If required samples and descriptive data shall be submitted, within the time specified in these specifications or if no time is specified within a reasonable time before use to permit inspection and testing, and shall be delivered as specified in these specifications and shall be properly marked to show the name of the material, trade name of manufacturer, place of origin name and location of work where the material represented by the sample is to be used and name of Contractor submitting the sample. Samples not subject to destructive tests may be retained until completion of the work but thereafter will be returned to the Contractor if he so requested in writing, at his own expense. Failure of any samples to pass the specified requirements will be sufficient cause for refusal to consider further any samples from the same manufacturer whose materials failed to pass the tests.
- d Catalogs for submittal shall have unrelated pages removed with capacities and specified parameters relating to the item or items clearly marked.
- e All items which form a system or subsystem that must be reviewed simultaneously because of coordination requirements shall be submitted concurrently.
- f The Contractor shall also furnish the Buyer with five copies of instruction books covering handling, storage, installation, operation, maintenance and spare parts provisioning for any equipment being furnished under this contract. These instruction books will be required 30 days prior to shipment of the equipment.

- g If the Contractor fails to submit for approval the required data within the specified time the Buyer will select a complete line of materials and/or equipment. If the Contractor submits for inclusion in the work materials and/or equipment not in accordance with the specifications the Buyer will have the right to reject them and select a full line of materials and/or equipment. The selection made by the Buyer will be final and binding and the items shall be furnished and installed by the contractor without change in the contract price.
- h All submittals shall be correct to Buyer requirements prior to the completion of the project and turned over to the Buyer.
- i Each submittal of drawings and data by the Contractor shall be accompanied by a letter of transmittal giving list of number titles of drawings status (Revision Number and Date) action to be taken and five properly executed copies of the Drawing Transmittal Form attached hereto.

Address to EG&G Rocky Flats Inc
Rocky Flats Plant Building 131
P O Box 464
Golden Colorado 80401 0464

- j Contractor shall further supplement the transmittal letter if necessary with other needed data clarifications. All prints reproducible and material submitted shall be stamped with the transmittal number. The Buyer will furnish blank copies of drawing transmittal forms for use by the Contractor.

01392 REVIEW OF SUBMITTALS

- a After receiving submittals the Buyer will promptly examine the drawings and/or data only for general arrangement, general dimensions and suitability and will approve them or return them with comments. This approval shall not relieve the Contractor of his responsibility for sufficiency of detail design or correctness of detailed dimensions.
- b Approval of descriptive submittals will not relieve the Contractor of the responsibility for correcting any errors which may exist or for meeting requirements of the specifications. No partial submittals will be accepted.
- c The Buyer will return reviewed submittal data to the Contractor within ten working days after receipt of each submittal. The Contractor shall schedule sufficient time in the procurement process for such review.

- d Within 10 days of receipt of returned submittals with comments the Contractor shall revise and resubmit for approval in the same quantity and in like manner stated above

LEGEND

- a Shop Drawings
- b Catalog Data
- c Equipment List
- d Material List
- e Elementary Diagrams and Wiring Diagrams
- f Installation Instructions
- g Maintenance Instructions
- h Operating Instructions
- i Samples, Colors
- j Certifications
- k Performance Curves
- l Design Data
- m Recommended Spare Parts Lists
- n Computations
- o Theory of Operation
- p Demolition Procedure

SUBMITTAL TABLE

Waste Handling Plant

- e The Contractor shall submit all forms data, information certificates schedules etc as required in other sections of the specifications Omission of an item from the above tabulation does not relieve the Contractor from the responsibility for submitting the item required
- f Complete submittals are required for all items of equipment or materials submitted for as equal consideration If the Contractor submits a letter stating that he is installing the exact material equipment or model number called out in the specifications no submittal is required

END OF SECTION 01300

| SECTION | DESCRIPTION | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r |
|---------|---|---------------|--------------|----------------|---------------|---------------------------------------|---------------------------|--------------------------|------------------------|-----------------|----------------|--------------------|-------------|------------------------------|--------------|---------------------|------------|-----------------------------|-------|
| | | Shop Drawings | Catalog Data | Equipment List | Material List | Elementary Diagrams & Wiring Diagrams | Installation Instructions | Maintenance Instructions | Operating Instructions | Samples, Colors | Certifications | Performance Curves | Design Data | Recommended Spare Parts List | Computations | Theory of Operation | Demolition | Material Safety Data Sheets | Other |
| 01500 | Temporary Facility Controls etc. | | | | | | | | | | x | | | | | | | | x |
| 01100 | Dust Control Plan | | | | | | | | | | | | | | | | | | x |
| 01700 | Construction Safety Reqs | | | | | | | | | | | | | | | | | | x |
| 02554 | Collection Gallery | | | | | | | | | x | x | | | | | | | | x |
| 02900 | Landscaping | | | | | | | | | | x | | | | | | | | |
| 03200 | Concrete Reinforcement | x | | | | | | | | | | | | | | | | | |
| 03300 | Cast-In-Place Concrete | | | | | | | | | | | | x | | | | | | x |
| 05500 | Structural & Miscellaneous Steel | x | x | | | | x | | | | | | | | | | | | |
| 09900 | Painting | | | | x | | x | | | x | | | | | | | | | |
| 13000 | Collection Well | x | x | | x | | | | | | x | | | | | | | | |
| 15050 | Equipment Installation | x | | | | | x | | x | | x | | | | | | | | |
| 15060 | Piping and Appurtenances | x | x | x | x | | x | | | | x | | x | | x | | | | |
| 15099 | Process Valves, Regulators and Miscellaneous Components | x | x | | x | | x | x | x | | x | | | x | | | | | |
| 15140 | Pumps | x | x | | x | x | x | x | x | | | x | x | x | x | | | | |
| 16010 | Electrical | | | | | | | | | | x | | | | | | | | x |
| 16050 | Basic Materials and Methods | | | | | | | | | | x | | | | | | | | x |
| 16150 | Electrical Equipment | x | x | x | x | x | x | x | x | | x | | x | x | x | | | | |
| 16450 | Grounding | | | | | | | | | | x | | | | | | | | x |
| 16700 | Heat Tracing | x | x | | | x | x | | | | | | x | | x | | | | |
| 17000 | General Instrumentation Control and Monitoring | x | x | x | x | x | x | x | x | | x | | x | x | x | | | | |
| 01610 | Mat'l Handling & Waste Disposal | | | | | | | | | | | | | | | | | x | x |

SECTION 01500
TEMPORARY FACILITIES CONTROLS
AND SPECIAL PROJECT REQUIREMENTS

01501 FIRE PROTECTION SYSTEMS

The Contractor shall be responsible for fire protection for his own vehicles facilities and equipment

01502 TEMPORARY FIELD OFFICE

The Contractor will not be required to furnish and maintain field office facilities for the Buyer however he shall provide for his own field office requirements if needed

When a Contractor provides a temporary office or storage facility that is either a trailer or a portable building a Contractor Yard/Trailer Use Permit see pages 01500 8 and 01500 9 must be completed and submitted to the Construction Management Inspection Manager for approval and issue

A trailer or portable building will be located near the construction site at a location designated by the Buyer, and must be secured in accordance with the Standard for Trailer Anchorage on page 01500 5

01503 GOVERNMENT FURNISHED PROPERTY (Refer to GP 62)

- a The Buyer will furnish to the Contractor as free issue the following property to be incorporated or installed in the work or used in its performance

| Item No | Quantity | Description |
|--------------------------|----------|------------------------------|
| D201, D202, D203 D204 | 4 | Influent Storage Tanks |
| D205 D206 D207 | 3 | Effluent Storage Tanks |
| Building 891 | 1 | Erected Building |
| Treatment System | 1 | Ion Exchange/Degasifier |
| | 1 | UV/Peroxide Treatment System |

- b Such property will be furnished on or before initiation of construction

- c Such property will be furnished at Rocky Flats Plant

01504 AVAILABILITY OF UTILITIES AND SERVICES (Refer to Special Provision No 7 and GP 79)

- a Potable water and electricity to complete construction of this contract work will be made available to the Contractor within 100 ft of the jobsite for work within existing building For work conducted outside existing buildings water and electricity will be made available at the nearest building or where designated by the Buyer
- b The Buyer and Construction Management Department will designate a parking area for the personal cars of the Contractor's employees These cars must remain parked at the designated area throughout the working day Only the Contractor's working vehicles will be permitted to be driven on the plantsite except before starting time and after quitting time
- c For interior work Construction personnel can use toilet facilities adjacent to the work areas for exterior work the Contractor shall furnish toilet facilities for his personnel
- d All 120 V, single phase, 15 and 20 A receptacle outlets serving tools, or equipment being used outside of buildings shall be equipped with ground fault circuit interrupters Such interrupters shall be furnished by the Contractor This requirement will be strictly enforced

01505 TESTING (Refer to Special Provision No 9)

- a If it is provided in the technical sections that a test is to be performed at Buyer expense, costs of any such test which reveals that the contract requirements have not been met will be paid by the Contractor and not the Buyer
- b The Contractor shall cooperate with the Buyer and any testing organization selected by the Buyer in the preparation for the performance of any test to be conducted by the Buyer or any testing organization selected by the Buyer
- c Tests of Pressure Vessels
 - 1 Prior to installation and acceptance by the Buyer any power boiler low pressure heating boiler or unfired pressure vessel that is included within the scope of the ASME Boiler and Pressure Vessel Code operated at pressures of 15 psi or greater furnished under this contract will be stamped with ASME Boiler and Pressure Vessel Code Symbol and a National Board of Boiler and Pressure Vessel Inspector's number thus certifying that all necessary tests have been

performed Manufacturer's data reports (unless exempted by the ASME Code) will be filed with the National Board in Columbus, Ohio

Five copies of these data reports and National Board Certificate shall be submitted to the Buyer

- 2 Any boilers or pressure vessels operated at pressure stated above utilized by the Contractor in his performance of the work, will be similarly tested and certified before being brought on the project annually thereafter so long as they are used on the project site
- d If it is provided in the technical specifications that the Contractor is to perform field radiography of welds the following shall apply
 - 1 All field radiography shall be performed by a radiographer who is licensed by the Department of Health State of Colorado
 - 2 Prior to starting such work, the Contractor shall present to the Buyer for his approval written procedures regarding
 - (a) The handling and use of the radioactive source on the plantsite and
 - (b) The operational methods to be followed in performing the field radiography

01506 WORK PERMITS

Before the start of any excavation or welding the Contractor shall request the appropriate work permit from the Buyer. Permits should be applied for well in advance of planned activities, to allow time for processing of permit applications. In addition a Confined Entry Permit will be required for construction activities inside the effluent storage tanks. For excavations involving installation of buried utilities, including electrical and alarm systems metallic coated plastic detector tape will be issued as GFE to the Contractor to be installed approximately 12 in directly above the buried utility or as directed by the Buyer

01507 UTILITY OUTAGES

The Contractor shall furnish the Buyer 48 hr advance notice of any planned utility outage

01508 LIGHTNING PROTECTION

New lightning protection systems shall be completed and in service (approved) prior to the time when the building or protected item is 85% complete as evidence by the Contractor's approved schedule and the Contractor's request for payment

SECTION 01610
MATERIAL HANDLING AND WASTE DISPOSAL

01611 WASTE DEFINITIONS

Construction projects deal with five types of waste as defined below

- a Off Site Sanitary Waste Routine, non radioactive non hazardous waste acceptable to public landfills Such wastes include paper waste cardboard plastic metal wood glass garbage (food waste) sand gravel concrete masonry products and miscellaneous construction debris Waste materials noted in this paragraph and generated from the buildings identified in the Approved Building List at the end of this Section shall be considered Off site Sanitary Waste

- b On site Sanitary Waste Waste materials described as in paragraph (1) above except coming from buildings and areas of the plant not identified in the Approved Building List Excess excavated materials asphalt street paving and waste generated from the exterior of all buildings (even those on the Approved Building List) shall be handled as on site sanitary waste Asbestos disposal must be handled as detailed in other sections of the Technical Provisions

- c Hazardous Waste Those waste materials exhibiting a hazardous characteristic (ignitible corrosivity reactivity or toxicity) or are listed in Colorado Hazardous Waste Regulations 5 CCR 1007 3 Examples of hazardous wastes include paint thinners, Freon, Trichloroethene, epoxy and enamel paints

- d Contaminated Waste Those waste materials that contain or are contaminated with radioactive materials

- e Mixed Waste Those waste materials containing both hazardous and contaminated materials

- f Empty Containers Those containers that have met the conditions set forth in 6 CCR 1007 3 261 7 Colorado Hazardous Waste Regulations and are therefore not considered hazardous wastes even though they may have contained hazardous or toxic materials at one time Empty containers shall only be disposed at the Rocky Flats on site landfill

01612 GENERAL REQUIREMENTS

- a The Contractor shall closely adhere to the following procedures to assure that all waste generated during construction will be properly dispositioned and disposed
- b A preconstruction conference will be held with the Contractor immediately after award of the contract. In addition to the standard review of procedural items including the Health and Safety Plan waste handling procedures will be reviewed with the Contractor
- c Submittals The Contractor will be required to submit a Waste Handling Plan for approval by the Buyer before starting construction. This plan will identify the types, location and approximate volume of the different kinds of waste that will be generated, on site storage locations permanent disposal sites to be used and a listing of subcontractors/vendors who will haul or dispose of waste materials. Contractor will submit Material Safety Data Sheets for all materials used and disposed
- d The Contractor shall use returnable containers and packages for all materials and supplies delivered to the jobsite whenever possible. The Contractor shall limit, as much as possible, the amount of waste accumulated during construction
- e All material and equipment being removed from buildings or exterior sites except those identified in the Approved Building List at the end of this Section shall be monitored by Radiation Monitoring before being removed from the area
- f The Contractor shall, at all times, keep the work area clean and orderly. All debris, scrap and rubble shall be removed from the work area as they are created. At the end of each work shift the work area shall be swept clean and left in a neat and orderly manner. Access routes for other personnel must be kept clear at all times
- g Installed equipment and materials removed by the Contractor under this contract and not authorized to be reused in the work shall remain the property of the Buyer. All such equipment and material shall be properly identified and delivered to the Buyer as directed by the Buyer. The Contractor shall use care in removing salvageable materials and equipment so as not to cause undue damage that may render the equipment or materials unusable

01613 WASTE DISPOSAL SITES

- a Waste disposal is approved for several locations depending on the nature and type of the waste materials These sites are

1 BFI Waste Systems Landfill This site is located three miles south of plant site on Highway 93 All materials approved as Off site Sanitary Waste shall be transported and dumped at this landfill The Contractor shall provide for all transportation however all dumping fees will be paid by the Buyer under an existing landfill contract with EG&G Rocky Flats Dumping fees shall not be included or reimbursed as part of the construction contract proposal

2 Rocky Flats On site Landfill This site is located one mile north of Guard Post 100 The Contractor shall provide for all transportation to this site No fees are required Waste materials approved for this site include waste that comes from buildings or areas that are not included on the Approved Building List but have been monitored by Radiation Monitoring as being non contaminated including

Excess excavated material

Asbestos (see technical sections 02080 if applicable)

Removed roofing materials containing or mixed with asbestos

Broken asphalt

Empty containers

- b The Rocky Flats On site Landfill will be open Monday through Friday from 7 45 a m to 11 a m and 12 30 p m to 2 p m Clean dirt and broken asphalt may be dumped until 3 30 p m
- c Other dumping areas for waste materials may not be used unless written permission is obtained from the Buyer for disposal at other sites
- d Concrete truck washout will be permitted at the Rocky Flats Landfill as noted on the Area Plot Plan in a location designated by the Buyer

01614 SANITARY WASTE DISPOSAL FROM APPROVED BUILDINGS

This subsection identifies the handling of construction rubble and waste that are considered suitable for disposal at the BFI Waste Systems Landfill Only waste generated from buildings identified in the Approved Building List at the end of this section shall be considered as Off site Sanitary Waste

- a The Construction Coordinator will maintain a separate log for each project that identifies each load transported. When a load is ready for offsite transport to the BFI Waste Systems Landfill, the Construction Coordinator will take a sequentially numbered copy of the Master Return Order to the Traffic Department who will then prepare a Bill of Lading authorizing shipment. The Contractor shall allow one hour after the waste is loaded in the transport vehicle for the preparation of documentation authorizing off site shipment of sanitary waste.
- b The Contractor will take the Bill of lading to the Shipping Department in Building 130. The Contractor will sign the Bill of Lading at the time and will retain the Security copy.
- c Plant Security personnel will stop each transport vehicle as it exits Guard Post 8 and will retain the Security copy of the Bill of Lading for each load before allowing the vehicle to continue on to the BFI Waste Landfill.
- d Off site Sanitary Waste does not require monitoring by Radiation Monitoring. All other types of waste must be monitored.
- e All waste material delivered to the Contracted Off site Sanitary Landfill will be disposed in accordance with the terms of that contract.
- f All loads taken off site must be fully secured and covered. Any additional dumping fees resulting from improper loading and handling shall be paid for by the Contractor.
- g All waste dumpsters furnished by the Contractor shall be locked at all times when not in use. The Contractor shall designate a custodian for each dumpster who is responsible for the collection control and surveillance of waste deposited in the dumpster.

01615 WASTE SEGREGATION CONTROLLED RELEASE AREAS

All areas of the plant other than those identified in the Approved Building List have the potential to contain multiple types of waste including on site sanitary and contaminated waste.

This subsection deals with the segregation and disposal of waste from these areas

The following steps govern the disposition segregation and disposal of waste as it is generated

- a The Construction Coordinator will arrange for a site survey by Radiation Monitoring before any demolition or excavation activities begin. This survey will identify potential waste types and identify construction procedures required for other than sanitary type waste
- b The Construction Coordinator will monitor the Contractor's compliance with his approved plan as well as compliance with all applicable Rocky Flats waste procedures. The Construction Coordinator will assist the Contractor in the identification of waste types, in particular contaminated versus on site sanitary waste. Any radiation Monitoring support or other EG&G involvement will be requested and coordinated by the Construction Coordinator
- c All waste will be segregated and monitored by Radiation Monitoring as it is generated and before loading for transport to a permanent disposal site. The Construction Coordinator will arrange for final monitoring by Radiation Monitoring of each loaded transport vehicle
- d On site sanitary waste shall be hauled to the Rocky Flats On site Landfill
- e The site survey conducted by Radiation Monitoring will identify low level radioactive and contaminated waste. The Construction Coordinator will also provide direction for the segregation of hazardous wastes. If improper segregation does occur or mixing of waste types is identified, segregation of on site sanitary waste will be attempted. If this is not possible the identified waste load will be handled as the appropriate waste type. Under no circumstances will contaminated or hazardous waste be shipped off site as sanitary waste.
- f Contaminated waste shall be deposited in waste boxes provided by the Buyer. Disposal of such boxes shall be the responsibility of the Buyer

01617 HANDLING AND DISPOSAL OF HAZARDOUS WASTE

- a Before bringing a hazardous material to Rocky Flats a Contractor must notify Industrial Hygiene and Hazardous Material Control through the Construction Coordinator. If a Material Safety Data Sheet (MSDS) for the material is not in Hazardous Materials Control's master file the Contractor must provide a copy thereof

- b The use of the chlorinated solvents 1 1 1 Trichloroethane (TRIC or Chloroethene VG) and Freon TF (Genesolv) as cleaners and degreasers has been discontinued at Rocky Flats as of October 1 1988 There are nonhazardous substitutes available including Alum Oakite NST Cleaner (as a 5% solution in water) and De Solv it Contact the Rocky Flats Construction Coordinator for the use and disposal of these substitutes or other substitute cleaners and degreasers proposed by the Contractor

APPROVED BUILDING LIST
(Revision 2)

| | | |
|-------|-----|-----|
| 331A | 020 | 443 |
| | 060 | 549 |
| T112A | 061 | 551 |
| T121A | | |
| T334B | 100 | 552 |
| T371A | 111 | 553 |
| T371C | 112 | 554 |
| T371D | 113 | 555 |
| T371F | 114 | 556 |
| T371G | 115 | 558 |
| T441A | 119 | 661 |
| T442A | 120 | 662 |
| T452A | 121 | |
| T452B | 124 | 675 |
| T452C | 127 | 900 |
| T452D | 128 | 920 |
| T452E | 129 | 931 |
| T452G | 130 | 987 |
| T690A | 131 | 988 |
| T690B | 250 | 993 |
| T690C | 333 | 995 |
| T690D | 335 | |
| T690E | 428 | |
| T690F | 429 | |
| T690G | | |
| T690H | | |
| T690M | | |

SECTION 1700

CONTRACTOR SAFETY REQUIREMENTS

01701 APPLICATION OF REQUIREMENTS

These safety requirements apply to all contractors performing work under direct contract or subcontract at the Rocky Flats Plant. Contractors shall be responsible for compliance by their subcontractors with the safety requirements of this contract.

01702 CODES AND REGULATIONS

The contractor shall take all reasonable precautions in the performance of the work to protect the safety and health of employees and others and to protect property. Contractors shall comply with applicable Federal, State and local codes and regulations for safety and health, including but not limited to:

- a Contract Work Hours and Safety Standards Act of 1969 and subsequent amendments
 - 1 Occupational Safety and Health Administration (OSHA) 29 CFR 1926 Safety and Health Regulations for Construction
- b Public Law 91 596 Occupational Safety and Health Act of 1970 and subsequent Amendments
 - 1 Occupational Safety and Health Administration (OSHA) 29 CFR 1910 Safety and Health Regulations for General Industry
 - 2 Occupational Safety and Health Administration (OSHA) 29 CFR 1904 Recording and Reporting Occupational Injuries and Illnesses
- c American National Standards Institute (ANSI) Standards as referenced in OSHA 29 CFR 1926 and 29 CFR 1910
- d National Fire Protection Association (NFPA) Codes as referenced in OSHA 29 CFR 1926 and 29 CFR 1910
- e Mine Safety and Health Administration (MSHA) 30 CFR 56 (for any quarrying or crushing activities)
- f The contractor shall be responsible for complying with new or modified industry codes and regulations that apply to this project/contract as they are promulgated during the term of this contract. Actual expenses incurred as a result of compliance with new or modified codes or regulations will be reimbursed to the contractor.

01703 DESIGNATED SAFETY PERSON

The contractor shall employ at least one person on site having overall safety responsibility and having the authority to perform required safety related duties. This individual may also function as the project superintendent with the approval of EG&G. The designated safety person will be required to attend additional EG&G safety training for this project. The contractor should budget eight (8) hours for this training.

01704 CONTRACTOR'S SAFETY PROGRAM REQUIREMENTS

- a Within 10 working days after award of this contract and before commencing work on the project the contractor shall submit to EG&G Construction Management a copy of the contractor's written health and safety program. The program will be reviewed and approved by EG&G Construction Safety prior to any contractor on site activity. The contractor's safety program shall include as a minimum
 - 1 Specific procedures requirements, equipment, and facilities to (1) eliminate hazards (2) reduce hazards to a minimum, or (3) guard against hazards associated with this project
 - 2 Provisions for daily project safety inspections to be completed by the designated safety person with hazards found and corrective actions taken recorded in a permanent log. The daily safety inspection log shall be signed by the designated site safety representative. The daily safety log shall be submitted to EG&G upon project completion.
 - 3 Provisions for removing from service any equipment which is found to be in a hazardous condition
 - 4 Provisions for the immediate reporting of all injury, illness and property damage incidents occurring at the Rocky Flats Plant to the EG&G Construction Coordinator
 - 5 Provision for the completion of comprehensive incident investigations and report. All incident investigation reports shall be submitted to EG&G Construction Management for review by EG&G Construction Safety within 24 hours of the incident. Reporting to EG&G shall be made on EG&G forms available from the EG&G project Construction Coordinator and provided at the pre construction meeting.

The contractor shall cooperate completely in all Critique Meetings initiated by EG&G to evaluate incidents

- 6 Provisions for the submitting of two (2) copies of the OSHA 200 Log on a monthly basis and two (2) copies of OSHA 200 Summary at project completion to the EG&G Construction Coordinator
- 7 Procedures for the immediate and subsequent treatment of injured workers Any contractor employee experiencing any injury or illness on the project shall report as soon as possible to EG&G Medical Department for evaluation EG&G Construction Management shall be notified whenever an employee reports to medical
- 8 Provisions for the training either site specific or otherwise required of all contractor employees and associated personnel in the recognition of project hazards The amount of time to be allotted for the training of contractor and subcontractor personnel exclusive of job task training, for this project shall be four (4) hours per craft employee and eight (8) hours per supervisory employee
- 9 Provisions for the utilization of only those persons adequately trained and competent to operate assigned equipment or perform assigned tasks Job task training conducted by the contractor, shall be a part of routine job assignments Training shall include the recognition of the hazards associated with the operation of assigned equipment or performance of job tasks
- 10 Provisions for safety and health meetings (tool box meetings) conducted on a weekly basis for all contractor employees Each meeting shall be approximately one hour in length occur during working hours and be specific to the project and shall include, at a minimum discussions of recent inspection findings and corrective actions incidents and upcoming safety requirements The Construction Coordinator shall be notified 24 hours prior to the safety meeting Upon completion of the meetings copies of reports and minutes shall be furnished to the EG&G Construction Coordinator within 24 hours
- 11 Provisions for project site posting of EG&G Construction Safety inspection reports
- 12 Provisions for five (5) working days advanced notification to the EG&G Construction Coordinator of

when equipment will be brought on site and of special activities, i e critical lifts road closures confined space entry hot work welding permits any power interruptions or outages etc

Moving equipment from one project site to another will require the five (5) day advance notice but flexibility will be extended if equipment is currently approved to be used on plant site EG&G Construction Management must be notified prior to any equipment move

- 13 Provisions for the control of repeat safety violations and violators
 - 14 Procedures for excellent housekeeping including immediate disposal of all trash and construction refuse This shall be performed continuously with end of day clean up A final clean up shall be completed at the end of the project and prior to the contractor leaving the site
- b The contractor shall communicate to its employees their safety rights (a work place free of recognized hazards with a procedure to make hazards known to management) and their safety responsibilities (to work in a safe manner) A DOE poster and complaint form provided by EG&G is required at all construction sites and construction offices
 - c Contractors key subcontractors and their safety personnel shall attend a pre construction safety meeting and general safety orientation conducted by EG&G A walk through inspection for site layout, plans housekeeping signs, traffic control project access control, etc will be conducted prior to construction start
 - d It is the responsibility of the contractor to orient all employees and subcontractors and their employees, to site safety working conditions and requirements
 - e EG&G will perform random safety checks/inspections of the work site and construction equipment and examine such documents as it may request from the contractor in connection with such safety checks/inspections The contractor shall cooperate in such checks and inspections
 - f The contractor shall complete all required corrective actions of identified hazards within the designated time frame The contractor's failure to comply with the issued corrective notices may result in (1), a second notice of noncompliance or (2) a stop work order for all or part of the project If the contractor again fails to complete the agreed on corrective action within the allotted time frame,

necessary corrective work may be instituted by EG&G and unilaterally charge the contractor for all costs thereof. Such charges will be deducted from payments otherwise due the contractor.

- g EG&G Construction Management may request the contractor to remove from the work site any employee deemed objectionable. The contractor shall remove, or have removed from the site:
 - 1 Employees whose actions or activities, either singularly or combined, create an unacceptable hazard to themselves, others, property, or who refuse to comply with the safety requirements of this contract.
 - 2 Contractors or subcontractors' supervisors who are unable or unwilling to manage personnel performance in compliance with the safety requirements of this contract.

01705 STOP WORK ORDERS

- a The contractor shall comply immediately with any stop work orders issued by EG&G through the Construction Coordinator. The contractor shall convey to its supervisors and workers EG&G's authority to stop all work when there is an imminent danger to worker's health and safety, imminent danger of property loss, failure to correct a hazardous condition or action in the allotted time frame and instances of repeat safety violations.
- b Work may resume only when the condition or action has been corrected to the satisfaction of EG&G. Written release to resume work will be provided by EG&G Construction Management with concurrence of EG&G Construction Safety.
- c The contractor shall not be entitled to claims for damages for losses incurred or for an extension of time as a result of the issuance of stop work orders due to contractor controlled hazardous conditions or actions or for compliance with safety requirements of this contract.

01706 JOB SAFETY ANALYSIS

- a Those contractors shall submit an overall project schedule identifying those events with critical safety impact or requirements or with a high potential hazard to personnel or property. Critical items require a Job Safety Analysis (JSA) which shall be reviewed and approved by EG&G Construction Safety prior to work starting on that critical activity. OSHA publication OSHA 3071 JOB HAZARD ANALYSIS should be used as a guide in preparation of the JSA and is available from EG&G Construction Management.

- b A JSA is the breaking down into component parts of any method or procedure and shall include
 - 1 A determination of the hazards connected therewith and associated with each step or task
 - 2 A determination of the requirements or qualifications of those who are to perform each step of the work
 - 3 Directions for implementing solutions to eliminate nullify, or reduce to a minimum the consequences of such hazards

01707 SITE SPECIFIC SAFETY REQUIREMENTS

EG&G Site specific construction safety requirements are those employing Rocky Flats Plant adopted policies, operating directives plant standards and codes applicable to this construction project. These requirements include the following and apply to all construction performed at Rocky Flats

- a All workmen will be required to wear hard hats. All visitors to posted construction areas will be required to wear hard hats
- b All compaction performed with vibratory equipment will be performed by workmen wearing approved foot protection devices
- c All contractor personnel will wear shirts that cover the shoulders, long pants, and work shoes on the plant site. Special protective equipment required to perform specific tasks will be worn when specified and in the proper manner
- d Ladders
 - 1 Three legged ladders are not allowed
 - 2 Aluminum ladders are not allowed for work in areas where there is electrical power equipment
 - 3 Industrial fiberglass ladders are allowed for all applications
 - 4 Wooden ladders are not allowed in radiological areas
- e A lift device known as the Xtraman Hoist or any lifting devices where by design the operator or any other person is used as the ballast or counterweight of the device is not to be used on construction projects

- f Safety eye wear with side shields will be worn at all times
Exceptions are when a passenger in a vehicle with no hazardous exposures or in an office
- g Limitations are placed on work activities due to wind speed and weather conditions as determined by the EG&G Construction Coordinator
- h Prior to brining ANY chemical on plant site, contact Industrial Hygiene 966 2780, for compliance directions in RFP Hazardous Communication Program Contractor will supply MSDSs for all materials used and/or disposed
- i Medical certifications required for this project will be determined by the Site Specific Safety and Health Program developed for this project Contractor employees required to have medical certifications shall have the necessary medical examinations completed off site and at the contractor s expense
- j Operation Health Physics requirements have been determined by the Site Safety and Health Program developed by the Buyer for this project
- k Submit a written Site Specific Health and Safety Plan prepared and signed by a Certified Industrial Hygienist, indicating the procedures to be used by the contractor to comply with the Rocky Flats Plant Environmental Restoration Site Specific Health and Safety Program Plan The Site Specific Health and Safety Plan must be approved by the Buyer prior to start of work

01708 INITIATION OF WORK

- a All contractor supplied equipment and tools shall be inspected by EG&G Construction prior to use on site Contractor shall be required to immediately shut down repair or remove from the Rocky Flats Plant any equipment not meeting safety codes
- b Any equipment that has been modified in any way after being brought on site and receiving the initial inspection shall be reinspected by EG&G Construction Safety
- c All construction work requires an EG&G Work Permit, which must be obtained through the EG&G Construction Coordinator and approved by EG&G Construction departments prior to start of any work activities Additional permits are required for specific activities All permits will be prepared and obtained by EG&G
- d The contractor shall immediately notify EG&G Construction Management of any safety related changes to the project

- e Routine safety meetings involving all contractors performing work at the Rocky Flats Plant will be held to discuss mutual problems findings trends etc EG&G Construction Management will notify contractors of such meetings Contractor shall attend regular and other construction safety meetings held by EG&G The site specific Health and Safety Plan will be reviewed with Contractors in preconstruction meetings

01709 CRITICAL 29 CFR 1926 STANDARDS FOR Remedial Action 881 Hillside

The successful contractor will be required to follow all federal state and local safety requirements, as well as Rocky Flats plant requirements The Contractor is solely responsible for the protection of its employees Methods of compliance with safety requirements are defined in the site specific Health and Safety Plan The Health and Safety Plan will be prepared by a Certified Industrial Hygienist

The following is a description of codes for work on Remedial Action 881 Hillside This work will be subject to both 29 CFR 1910 and 29 CFR 1926 In particular the contractor should pay close attention to the following standards All parts of 29 CFR 1910 and 29 CFR 1926 will be enforced, but the following standards are of special importance to the stated description of work

| | |
|-----------------------|---|
| 29 CFR 1910 134 | Requirements for a Minimal Acceptable Program |
| 29 CFR 1910 120 | Hazardous Waste Operations and Emergency Response |
| 29 CFR 1910 20 | Access to Employee Exposure and Medical Records |
| 29 CFR 1926 103 | Respiratory Protection |
| 29 CFR 1926 Subpart L | Ladders & Scaffolds |
| 29 CFR 1926 100 104 | Personal Protective Equipment |
| 29 CFR 1926 251 | Rigging Equipment and Material Handling |
| 29 CFR 1926 Subpart J | Welding and Cutting |
| 29 CFR 1926 550 | Cranes and Derricks |
| 29 CFR 1926 552 | Material and Personnel Hoists |
| 29 CFR 1926 Subpart R | Steel Erection |

Though special attention must be given to the above standards, that does not relieve the contractor of his responsibility to follow all requirements of 29 CFR 1926 or RFP site safety requirements

The successful contractor's safety and health plan shall describe how the contractor plans to comply with the indicated 29 CFR 1926 regulations

01710 POST CONSTRUCTION ACTIVITIES

The contractor shall submit a final report to EG&G Construction Safety detailing their safety performance during the project. This report shall be submitted within 10 working days after EG&G accepts the project.

SECTION 02200

EARTHWORK

PART I GENERAL

1 1 APPROVAL Prior to starting any excavations an approved excavation permit and written permission shall be obtained from the Buyer

1 2 PROTECTION AND SAFETY

A Traffic Control

- 1 Keep all roads sidewalks and parking areas that are not part of this project usable at all times
- 2 The Buyer shall provide all necessary barricades lights signals etc for the protection of the workers and the public as established by the Occupational Health and Safety Administration (OSHA) Construction Safety and Health Regulation 29 CFR Part 1926, Subpart G Signs Signals and Barricades
- 3 All non essential vehicles are prohibited from the construction site

B Excavations, Trenching and Shoring

- 1 All excavations trenching and shoring shall comply with the rules and regulations as established by OSHA Construction Safety and Health Regulations 29 CFR Part 1926 Subpart P Excavation Trenching and Shoring
- 2 OSHA Pamphlet 2226 Excavation and Trenching Operations can be used as an additional aid
- 3 All construction activities shall be performed so as to minimize the generation of fugitive dust Soils shall be wetted to control dust during excavation work on access roads and in high traffic areas The Contractor will be required to develop a Dust Control Plan to be submitted to the Buyer for approval

C Environmental Protection

1 Erosion and sediment control measures

- a The rate of runoff entering the construction site shall be retarded and controlled through the use of temporary erosion bales. This work encompasses furnishing, installing, and removing erosion bales as required for this purpose or directed by the Buyer. Erosion bales shall consist of hay, straw, or other approved material containing approximately 5 cubic feet of material weighing not less than 35 lbs and securely tied. Erosion bales will be anchored to the ground with #4 reinforcing steel bars approximately 4 feet long or 2 inch x 2 inch x 3 feet long wood stakes.
- b The rate of runoff from the construction site shall be mechanically retarded and controlled by benches, berms, and silt fences. Silt fences shall be furnished, installed, and removed as required to control runoff or as directed by the Buyer. Mirafi 100x sediment control fabric or Buyer approved equal shall be used. Posts shall be metal or wood (4 inch minimum width) with a minimum length of 5 feet driven to a depth of 2 feet at 6 feet spacing. The wire fence shall be chicken wire or approved equivalent and with wire ties or staples. The plastic filter cloth (42 wide) will be secured to the top of the wire fence with wire ties. The bottom edge of the filter cloth shall be buried in a trench 6 inches deep along the base of the fence to prevent underflow. The post, wire fence, and filter cloths shall be removed and the accumulated sediment removed as excess fill.

2 South Interceptor Ditch

The South Interceptor Ditch will be protected as a wetland area as much as possible during construction. Construction shall take place so as to avoid excavation, stockpiling soil, vehicular traffic, or other construction activities in low lying areas of the South Interceptor Ditch. The South Interceptor Ditch will be restored to its original condition after construction.

1 3 EXISTING UTILITIES

- A Notify the Buyer immediately when existing utilities are encountered during excavation.

- B Obtain approval from the Buyer before backfilling existing utilities
- C The influent/effluent pipeline collection well pipeline and collection gallery all cross an existing natural gas supply main owned and operated by Western Gas Supply Co 1050 17th Street Suite #500 Denver Colorado 80265 The Contractor shall notify Western Gas (West Gas) thirty days prior to construction of trenches which cross the gas main

PART II PRODUCTS

2 1 EXCAVATED MATERIAL

- A Material to be excavated is assumed to be earth and other materials that can be removed with a power shovel
- B If rock is encountered within the limits of excavation notify the Buyer immediately and do not proceed except as instructed
- C Contaminated soil if encountered shall be stockpiled separately from clean soil Contaminated soil shall not be used as fill The Contractor shall notify the Buyer if contaminated soil is encountered

2 2 FILL MATERIALS

- A Fill material for structures and utility trenches shall be granular soils free of organic matter
- B Sand fill shall pass a 20 mesh and be retained on a 200 mesh U S Standard sieve and shall be free of organic material trash, and debris
- C Frozen materials shall not be used for fill
- D All suitable material removed from the excavation shall be used in forming fills No excavated material shall be wasted without approval of the Buyer
- E Fill for storage areas and roads shall consist of overburden and bedrock materials including broken asphalt pavement obtained from excavated areas
- F Water, Gas, and Underground Conduit Embedment Material
This material shall be sand fill
- G Class I Structural Fill Suitable excavated material containing no stones having a diameter greater than 1 in
- H Class II Structural Fill -- Suitable excavated material containing no stone having a diameter greater than 6 in

- I Sewer Line Embedment Material This material shall consist of angular $\frac{1}{2}$ to $1\frac{1}{2}$ in graded stone (ASTM D2321)
- J Drain Rock This material shall consist of $\frac{1}{2}$ inch to $\frac{3}{4}$ inch washed and cleaned round gravel
- K Top Soil This material shall consist of soil within 1 foot of the ground surface This material is not suitable for support of structural loads or use as backfill
- 2 3 WARNING TAPE Warning tape shall be furnished by Buyer and installed by Contractor
- 2 4 RIPRAP
- This work shall consist of the construction of riprap in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans or established
- Riprap shall consist of hard dense sound rough fractured stone as nearly cubical as practicable Thin slab type stones and flaking rock shall not be used The stone shall have a specific gravity of at least 2.25
- Stone size (equivalent spherical diameter) shall nominally be 12 inches and may generally range from 3 inches to 18 inches
- Stone shall be well graded in order that the voids can be filled and at least 50 percent of the mass shall be stones equal to or larger than the nominal size Stone size shall not be larger than the thickness of riprap

PART III EXCAVATION

3 1 GENERAL

- A The worksite and areas shown on the Drawings shall be cleared of all natural obstructions and existing foundations pavements utility lines and other items that will interfere with the construction operations, as approved by the Buyer
- B Proper allowances shall be made for form construction waterproofing shoring, and inspection Where walls or footings are authorized to be deposited directly against excavated surfaces the surfaces shall be sharp clean and true Bottoms of excavations for footings piers grade beams, etc shall be level clean and clear of loose materials

- C Trenching for utility systems shall be of sufficient width for proper laying of pipe and conduit. The trench banks shall be as nearly vertical as is practical. Undercutting will not be permitted. Trenches shall be of sufficient depth to provide not less than the minimum cover shown on the drawings.
- D Protect bottoms of all excavations from free standing water and frost. Do not place foundations, footings, grade beams or slabs on wet or frozen ground.
- E Suitable excavated material that is required for fill under slabs shall be separately stockpiled as directed by the Buyer.
- F Soil from areas designated as Solid Waste Management Units (SWMUs) shall not be removed from the limits of these areas as located in the field. Field location markers of SWMUs within the worksite shall be maintained during construction activities.
- G Clearing and Grubbing shall be performed within the limits of excavation as shown on the Drawings. Within the specified areas, all trees, brush, stumps, logs and tree roots shall be removed and disposed of as per Item 3.9 of this section.
- H Stripping of topsoil shall be conducted in all excavation and fill areas. Topsoil shall be removed to a depth of one foot and shall be stockpiled separately from other excavated material for use in finish grading. Any artificial fill or rubbish, organic material or other deleterious material encountered in the stripping operation shall be removed to its full depth and disposed of as per Item 3.9 in this section.

3.2 OVEREXCAVATION

- A All unstable materials encountered below the established elevation of the excavation that will not provide a firm foundation for subsequent work shall be removed.
- B Where the excavation is directed to be made below the established elevations, the excavation, if under slabs, shall be restored to the proper elevation in accordance with the procedure specified for backfilling or if under footings, the depth of the walls or footing shall be increased as may be directed by the Buyer.
- C Excavations carried below the depth indicated WITHOUT SPECIFIC DIRECTION shall be returned to the proper elevation in accordance with the procedure specified for backfilling except that in wall or footing excavations, the concrete shall be extended to the bottom of the excavation.

3 3 BACKFILLING

- A Prior to backfilling remove all forms and clean excavations of all trash and debris
- B Trenches for piping conduits or other underground utilities shall be backfilled to a minimum of 6 in over the top of the pipe conduit cable etc with sand fill unless otherwise detailed on the drawings
- C Fill shall be placed in horizontal layers not in excess of 6 in in thickness and shall have a moisture content of plus or minus 2 percent of optimum moisture content such that the required degree of compaction may be obtained Each layer shall be compacted by hand or machine tampers or by other suitable equipment to 90% of maximum density as determined by the Modified Proctor Testing Method
- D Install Buyer furnished warning tape 12 in above any underground utilities
- E Spreading Fill Material
 - 1 Completed fill shall correspond to the contours shown on the drawings
 - 2 Place fill materials in successive layers of loose materials not more than 6 in deep
 - 3 Uniformly spread each layer using a road machine or other approved device
 - 4 Compact each layer of fill thoroughly using an approved roller to obtain 90% maximum density as determined by the Modified Proctor Testing Method ASTM D 1557

3 4 SUBGRADE PREPARATION

Subgrades not requiring fill shall be prepared as follows

- A Subgrade Preparation
 - 1 Rough grade the surface to the approximate final shape of subgrade required
 - 2 Scarify the surfaces to a maximum depth of 6 in and thoroughly cultivate until the material is finely divided
 - 3 Alternately water and recultivate the subgrade material to obtain the optimum moisture content required for compaction Minimum depth of moistened subgrade shall be 6 in

B Shaping

- 1 Shape subgrade to a true cross section sufficiently higher than the specified grade to allow for compaction
- 2 Rough grading shall be done in a manner that will not leave ridges of material that will interfere with the immediate drainage of water from the subgrade
- 3 During shaping and compacting any high spots or depressions that develop in the subgrade shall be scarified cut down or backfilled and compacted as specified below

C Wetting and Compacting

- 1 Furnish sufficient watering equipment to ensure proper moisture content of all materials being placed
- 2 Sprinkle each course of material in a manner that will avoid areas of dry material alternated by areas of saturated soil or pools of water

3 5 PLACEMENT OF FILL ABOVE GRADE

A Preparation of Ground Surface

- 1 Where fill is placed over existing pavement or compacted gravel scarify and compact the existing surface before placing fills
- 2 Uniformly moisten areas to receive fill and compact to minimum 90% of maximum density as determined by the Modified Proctor Testing Method

3 6 COMPACTION

- A Except as otherwise specified moisture/density relationships will be as determined by the American Society for Testing and Materials (ASTM) D1557 and the degree of field compaction shall be controlled with ASTM D1556 or ASTM D2922 All tests will be taken by the Buyer
- B The Buyer will pay for any test for soil compaction that passes the requirements of the specifications but the Contractor shall pay for any soil tests that indicate the soil compaction does not meet requirements of the specifications

3 7 GRADING

- A Uniformly smooth grade all areas covered by the project including excavated and backfilled sections and adjacent transition areas The degree of finish shall be that ordinarily obtainable from either blade graded or scraper operations
- B The finish surface shall be not more than 0 15 ft above or below the established grade or approved cross section
- C All drainage swales shall be finished so as to drain readily

3 8 RIPRAP

Riprap shall be placed to conform to the drawings The larger size stones composing the riprap material shall be placed first and roughly arranged in close contact The spaces between the larger stones shall then be filled with smaller stone of suitable size so placed as to leave the surface evenly stepped conforming to the contour required The material may be machine place with sufficient hand work to accomplish requirements of this specification

Excavation for toe or cut off walls shall be made to the neat lines of the wall Allowance will not be made for work outside the neat lines

3 9 DISPOSAL OF DEBRIS AND EXCESS MATERIAL

- A Rubble and debris not suitable for fill shall be transported to a sanitary landfill 1 mile northeast of Access Gate B
- B Excess material from excavation unsuitable for or not required for backfilling shall be wasted spread and leveled or graded as directed by the Buyer within 1 mile of the site

3 10 DEWATERING Water from construction operations storm water or ground water resulting from dewatering of excavations shall be transferred by the Contractor to tanks provided by the Buyer

END OF SECTION 02200

SECTION 02554
COLLECTION GALLERY

PART I GENERAL

1 1 RELATED WORK SPECIFIED ELSEWHERE

- A Section 02110 Demolition
- B Section 02200 Earthwork

PART II. PRODUCTS

2 1 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A Influent Pipe Schedule 80 ASTM D 1785, Type I
- B Drain Pipe Schedule 80 perforated
- C Pipe Fittings Schedule 80 socket weld ASTM D 2467 Type I
- D Cement for Socket Weld Joints Solvent cement in accordance with ASTM F 493 and as recommended by the manufacturer of the pipe and fittings
- E Primer Primer as recommended by manufacturer of the pipe and fittings

NOTE

PVC pipe and fitting joints shall be solvent welded with the exception of equipment connections which may be threaded or flanged. Fabrication and installation shall be in accordance with the recommendations of the manufacturer of the pipe and fittings. If threaded connections are required, solvent weld threaded adapters shall be used in place of threading the pipe.

2 2 GEOMEMBRANE

- A The geomembrane shall be made of polyvinyl chloride (PVC)
- B The geomembrane shall be 40 mil (.040 inch) minimum certifiable thickness
- C The geomembrane shall be free of holes, blisters, undispersed raw materials, defects, and foreign material. The geomembrane shall be uniform in color, size, and thickness and shall contain no additive that will leach out or cause deterioration over time.

D Geomembrane packaging shall be labeled with the material name length width thickness, roll or package number, manufacturing lot number and manufacturer identification

E Manufacturer certification of geomembrane material properties shall be delivered to the worksite with the material The certification shall include results of the required tests specified in this subpart as performed by the manufacturer on representative samples of each manufacturing lot

F The geomembrane shall meet or exceed the following minimum average roll requirements

| <u>Property</u> | <u>Test Method</u> | <u>Requirement</u> |
|--|---|--------------------|
| Thickness | ASTM D 1593 | 40 mil $\pm 7\%$ |
| Specific Gravity | ASTM D 792 | 1.213 min |
| Tensile Strength at Break each direction | ASTM D 882 | 2000 psi |
| % Elongation at Break each direction | ASTM D 882 | 250% minimum |
| Resistance to Soil Burial | ASTM D 3083 | |
| Tensile Strength Change, each direction | | 5% max |
| Elongation Loss each direction | | 20.0% max |
| Tear Resistance each direction | ASTM D 1004 | 200 lb/in min |
| Water Extraction | ASTM D 1239, as modified by ASTM D 3083 | 0.35% max |
| Volatile Loss | ASTM D 1203 | 1.0% max |

G Minimum requirements for the geomembrane material shall be verified by submitting one representative sample for every 25,000 square feet of installed geomembrane to an independent laboratory Test methods specified in this subpart shall be performed on the geomembrane samples by the independent testing laboratory

2 3 GEOTEXTILE

- A The geotextile shall consist of a material composed of at least 85 percent by weight of polyolefins polyesters or polyamides The geotextile shall be resistant to chemical attack rot and mildew
- B The geotextile shall have a nonwoven structure and a weight per unit area of not less than 6 ounces per yard as per ASTM D 3776
- C The geotextile shall be free of blisters undispersed raw materials, imperfections, defects and foreign material The geotextile shall be uniform in color, size and thickness, and shall contain no additive that will leach out or cause deterioration over time
- D Geotextile packaging shall be labeled with the material name length width thickness or unit weight roll number manufacturing lot number and manufacturer identification The fabric shall be labeled as per ASTM D 4873
- E Manufacturer certification of geotextile material properties shall be delivered to the worksite with the material The certification shall include results of the required tests specified in the subpart as performed by the manufacturer on representative samples of each manufacturing lot
- F The geotextile shall meet or exceed the following minimum average roll requirements

| <u>Property</u> | <u>Test Method</u> | <u>Requirement</u> |
|-------------------------|-------------------------------|------------------------------------|
| Tensile Strength | ASTM D 4632 | 180 lbs min |
| Elongation | ASTM D 4632 | 15% max |
| Puncture Strength | ASTM D 4833 (Bevelled rod) | 80 lbs min |
| Mullen Burst Strength | ASTM D 3786 | 290 psi min |
| Trapezoidal Tear | ASTM D 4533 | 50 lbs min |
| Apparent Opening Size | ASTM D 4751 | 100 mesh average 70 mesh max |
| Permittivity | ASTM D 4491 | 0.5/sec min |
| Ultraviolet Degradation | ASTM D 4355 | 70% min of tensile strength |

- G Minimum requirements for the geotextile shall be verified by submitting one representative sample for every 50,000 square feet of installed geotextile to an independent laboratory Test methods specified in this subpart shall be performed on the geotextile samples by the independent testing laboratory

2 4 GEONET

- A The geonet shall be made of high density or medium density polyethylene (HDPE or MDPE) The geonet shall be made with extruded cross linking solid ribs
- B The geonet shall be 250 mil (0 250 inch) minimum certifiable thickness as per ASTM D 1777 Aperture size of the geonet shall be no less than 0 25 inch in any direction
- C The geonet shall be free of imperfections, defects and foreign material The geonet shall be uniform in color size and thickness and shall contain no additive that will leach out or cause deterioration over time
- D Geonet packaging shall be labeled with the material name dimensions manufacturer and manufacturing lot number
- E Manufacturing certification of geonet material properties shall be delivered to the worksite with the material The certification shall include results of geonet testing as deemed appropriate by the manufacturer as performed by the manufacturer on representative samples of each manufacturing lot

2 5 BACKFILL MATERIAL

See Section 02200

2 6 WARNING TAPE Furnished by Buyer and installed by Contractor

2 7 GROUT 2000 psi cement grouting

PART III EXECUTION

3 1 FRENCH DRAIN

- A
 - 1 Excavation The trench shall be excavated per the specification in Section 02200 and according to the Drawings
 - 2 Excavated material from newly constructed portions of the collection gallery shall be used as structural backfill for previously constructed portions of the collection gallery Construction shall be performed in such a manner that excavated soil will not be stockpiled Excess excavated soil shall be stockpiled north of previously completed portions of the collection gallery This specification will preclude the excavation of the

entire length of the collection gallery prior to synthetic material and drain rock installation and backfilling

B Grout as needed to maintain impermeability of bedrock

C Geomembrane

- 1 The membrane shall be handled in a manner to prevent puncture or damage. Damaged sections of the geomembrane will not be used. Installation will be performed by a Contractor or Subcontractor who has previously installed a minimum of 1 000 000 square feet of PVC liner.
- 2 The top surface of the geomembrane subgrade shall be rolled or otherwise suitably prepared to receive the liner and shall be smooth, dry, compacted, and free of sharp objects and debris that could puncture the geomembrane. Sharp objects and debris shall be removed as necessary. The geomembrane Manufacturer or Installer shall certify in writing that the condition of the geomembrane subgrade is acceptable and that it does not conflict with and therefore does not void any conditions of warranty.
- 3 The geomembrane shall be installed in the trench to cover the up gradient face of the bedrock, the bottom of the trench, and as a groundwater cut off wall on the down gradient face of the trench as shown on the Drawings. Care should be taken not to cover the up gradient side of the trench above the top of the bedrock.
- 4 The impermeable membrane shall be field seamed per the manufacturer's recommendations as required to meet the dimensions on the Drawings. Individual manufactured panels shall be factory fabricated into large panels to the maximum extent possible to minimize field seaming. All factory fabricated seams and field seams shall have a strength of at least 80% of the specified geomembrane sheet tensile strength. Factory fabricated seams shall be tested by destructive and nondestructive methods as per ASTM D 4545. Field seams shall be tested by trial welds, destructive test methods, and nondestructive test methods as per ASTM D 4437. Field destructive tests shall be performed only at locations within the top 3 feet of the cutoff wall.
- 5 Field seams will be formed by lapping the edges of panels a minimum of 6 inches. The contact surfaces of the panels shall be wiped clean prior to welding or adhesion. Patches in the geomembrane will be

constructed with geomembrane sheet material will be bonded by the same method used for factory or field seaming and will overlap the area to be repaired by a minimum of 6 inches on all sides. All field seams and factory fabricated seams of the cutoff wall shall be vertical when installed. Field seaming shall result in a homogeneous bond which is durable, strong, and air tight.

- 6 The geomembrane shall be installed in a relaxed condition free of stress or tension.
- 7 Pipe penetrations through the impermeable membrane shall be sealed per manufacturer's recommendations and details on the Drawings.
- 8 A representative of the geomembrane Manufacturer or Installer shall be present during backfilling of soil against the geomembrane to ensure the integrity of the installed liner.
- 9 Unless otherwise authorized by the Buyer, the temperature range for geomembrane installation is 40 to 105 F. As a minimum, the Buyer will require that a performance evaluation of temperatures outside this range be made through a trial seam and destructive testing program.
- 10 Geomembrane installation shall not be attempted when wind velocity and/or dusty conditions interfere with liner placement, alignment of seams, or cleanliness of seam area, nor when precipitation (i.e., raining, sleet, snow, frost, or heavy dew) interferes with having a dry seaming surface.
- 11 Wind displacement or damage of the geomembrane shall be prevented by placement of an adequate quantity of sandbags onto all exposed geomembrane panels. Under no circumstances shall installed geomembrane or geomembrane panels be left overnight without adequate protection from wind.

D Geotextile

- 1 The geotextile shall be handled in a manner to prevent puncture or damage. Damaged sections of the geotextile will not be used.
- 2 The geotextile shall be kept dry and wrapped such that it is protected from the elements during shipping and storage. At no time shall the geotextile be exposed to ultraviolet light for a period exceeding fourteen days.

- 3 Sections of the geotextile shall be seamed by overlapping sections by a minimum of 1 foot and heat bonding. Heat bonding shall be performed in such a manner as to prevent heat damage to synthetic components. For horizontal seams the upper section will overlap the lower section to prevent backfill material from entering behind the geotextile. Geotextile installed on slopes of 40 degrees (measured from the horizontal) or steeper shall have vertical seams only.
- 4 Prior to placement of the geotextile the surface will be prepared to a smooth condition free of debris, depressions or obstructions which may damage the geotextile. The geotextile shall be laid smooth without excessive wrinkles. The geotextile shall not be dragged across the subgrade. The geotextile shall be placed in the excavation, followed by the aggregate which shall be placed so as to prevent damage to the geotextile. Fill material will be placed over the fabric and compacted to hold the fabric in place. Any damage to the geotextile shall be repaired by placing a patch extending three feet in all directions beyond the damaged area.
- 5 Geotextile is to be installed along the geomembrane, around the drain rock and geonet, and around the drain pipe as shown on the Drawings.
- 6 Pipe penetrations through the geotextile shall be sealed per manufacturer's recommendations and details on the Drawings.

E Pipe Bedding

The bottom of the trench shall be covered with two feet of drain rock so as to provide the drain pipe with a firm and uniform bearing surface over the entire length of the pipe.

F Laying Drainpipe and Installing Fittings

- 1 The Contractor shall provide the necessary mason's lines and supports to ensure installation of the pipe in accordance with the Drawings. Facilities for lowering the pipe into the trench shall be such that neither the pipe nor the trench will be damaged or disturbed.
- 2 The Buyer shall inspect all pipe and fittings before they are installed and reject any piece that is damaged by handling or defective to a degree which will materially affect the function and service of the pipe.

- 3 The Contractor shall take adequate measures to prevent the intrusion of foreign materials of any kind into the pipe or fittings. At the end of each day's work the Contractor shall adequately plug any open ends of installed pipe and fittings in order to prevent the intrusion of foreign materials.
- 4 The pipe shall be wrapped with a single layer of geotextile. The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform.
- 5 Pipe shall not be installed on frozen, soft, or spongy subgrade material. Pipe shall not be installed in standing water. The Contractor shall furnish all necessary equipment and labor to properly dewater the trench as the need arises at the Contractor's cost.
- 6 Pipe which is not reasonably true in alignment or grade or which shows any settlement after laying shall be taken up and relaid without extra compensation to the Contractor.
- 7 Pipe and fittings shall be joined in accordance with accepted industry practice.

G Existing Natural Gas Pipeline

- 1 Construction is required in the vicinity of an existing 8 inch diameter natural gas pipeline. The approximate location of this pipeline has been field located and is shown on the drawings. The existing natural gas pipeline crosses the alignment of the influent and effluent pipeline, the collection well pipeline, and the collection gallery.
- 2 It will be required to excavate below and along approximately 50 feet of length of the existing natural gas pipeline at the crossing of the pipeline with the collection gallery alignment. The Contractor shall support the pipeline as specified by and under the supervision of Western Gas Supply Company during construction of the collection gallery. The Contractor shall notify Western Gas Supply Company 30 days in advance of construction in the vicinity of the pipeline.

H Existing Monitoring Wells

- 1 Construction is required in the vicinity of several existing monitoring wells along the alignment of the collection gallery.

- 2 Each existing monitoring well located within the limits of excavation (up to 30 feet from either side of the collection gallery alignment shown on the drawings) shall be properly abandoned prior to excavation by overdrilling, removal of casing and gravel pack and filling with grout from the bottom of the well to the ground surface
- 3 Existing monitoring wells located outside of the limits of excavation of the collection gallery shall be protected from damage during construction activity. In the event of damage to an existing monitoring well during construction activities the damaged well shall be properly abandoned as specified in this subpart prior to closeout of the job

I South Interceptor Ditch

- 1 The South Interceptor Ditch shall be protected as a wetlands area
- 2 Construction activities shall be conducted in such a manner that preserves the integrity of the South Interceptor Ditch. Excavation, stockpiling or filling of soil shall not take place within the South Interceptor Ditch. Construction equipment shall not traverse across or along the South Interceptor Ditch except as approved in writing by the Buyer. A plastic safety fence or similar barricade shall be placed along the South Interceptor Ditch south of the collection gallery prior to the initiation of construction activities

J Backfill Trenches shall be backfilled and restored to their original contours as shown on the Drawings and as described in Section 02200 Earthwork

K Field Markers Field markers consisting of steel fence posts shall be painted orange and driven 2 feet into the ground at specified locations to mark the as built location of the collection gallery. Field markers shall be placed along the intersection of the upgradient slope of the collection gallery trench with the ground surface and 3 feet south of the intersection of the downgradient slope with the ground surface. Field markers shall be placed at endpoints, turnpoints, at points of intersection and at locations every 200 feet along the collection gallery

END OF SECTION

SECTION 02900

LANDSCAPING

PART 1 GENERAL

- 1 1 DESCRIPTION Provide landscape work complete as indicated specified and required
- 1 2 VERIFICATION OF DIMENSIONS AND QUANTITIES All scaled dimensions are approximate Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities and shall immediately inform the Buyer of any discrepancies between the Drawings and/or Specifications and actual conditions No work shall be done in any area where there is such discrepancy until approval has been given

PART 2 PRODUCTS

2 1 MATERIALS

A Fertilizers and Soil Conditioners All materials shall be first grade commercial quality and shall have certificates of source of material, analysis and quantity or weight attached to each sack or container Delivery certificates shall be given to Inspector as each material is delivered A list of materials used together with typical certificates of each material shall be submitted to the Buyer prior to the final acceptance of the job

- 1 Organic Amendment shall be sawdust derived from wood or redwood conforming to the following specifications

a Physical properties

| Percent Passing | Sieve Sizes |
|-----------------|-----------------------------|
| 95 100 | 1/4 inch (6 35 mm) |
| 80 100 | No 8 8 mesh (2 38 mm) |
| 0 30 | No 35, 32 mesh (500 micron) |

b Chemistry

Nitrogen content (dry weight basis) 0 4 0 6%
Iron content (dry weight basis) Minimum 3 5
millimhos/centimeter at 25 C as determined by
saturation extract method
Ash (dry weight basis) 0 6 0%

- 2 Commercial Fertilizer shall be 6 20 20 pelletized
- 3 Iron Sulfate shall be sulfate of iron

4 Maintenance Fertilizer shall be 16 6 8 dry commercial type

B Native Seed Mix

All seed shall be furnished in bags or containers clearly labeled to show the name and address of the supplier the seed name the lot number net weight origin the percentage of weed seed content the guaranteed percentage of purity and germination pounds of live seed (PLS) of each seed species and the total pounds of pure live seed in the container The following native seed mix shall be used

| Common Name | Botanical Name | Pure LWE Seed (PLS) LBS /Acre |
|------------------------|------------------------|----------------------------------|
| Western Wheatgrass | Agropyron smithii | 5 |
| Blue Grama | Bouteloua gracillis | 2 |
| Smooth Brome v Lincoln | Bromus inermis | 8 |
| Pubescent Wheatgrass | Agropyron trichophorum | 2 |
| Sand Dropseed | Sporobous cryptandrus | 0 25 |
| Sideogis Grama | Bouteloua curtipendula | 3 |
| Gresied Wheatgrass | Agropyron desertorum | 5 75 |
| Annual Rye | Lolium multiflorum | 1 |
| Total PLS | LBS /Acre | 27 00 |

C Topsoil

Topsoil for use as cover in all disturbed areas has been stripped and stockpiled separately from other soils during excavation activities If imported topsoil is required it will comply with the following standards

Topsoil shall have an acidity reaction of 6 0 to 8 0 pH and contain a minimum of 5% and a maximum of 20% organic matter if added it must have a carbon to nitrogen ration of 30 1 or less

Topsoil shall contain the following minimum ammonium bicarbonate DTPA (chelate) extractable nutrients (this is the extracting solution used by CSU Soil Testing Laboratory)

| | |
|------------|---------------------|
| Nitrogen | 20 ppm ^a |
| Phosphorus | 10 ppm |
| Potassium | 120 ppm |
| Iron (Fe) | 5 ppm |

^a Air dried basis

Topsoil shall not include any materials or elements detrimental to plant growth Soluble salts measured in saturation extract should be less than 3 mmhos/cm

Representative sample of topsoil shall be submitted to the Buyer for approval with soil test results in accordance with method of soil analysis used at the Colorado State University soil testing laboratory

PART 3 EXECUTION

3 1 GRADING SOIL PREPARATION AND FERTILIZING

- A Preparation Prior to fertilizing the soil in all seeding areas that facilitate the use of a tractor, it shall be cross ribbed to a depth of 12 inches Small areas shall be tilled or hand dug to a depth of 6 inches Rocks larger than 3 inches in diameter shall be removed from the site
 - 1 Moisture Content Soil shall not be worked when the moisture content is such that dust will form in the air or that clods will not break readily Water shall be applied if necessary to provide ideal moisture content for filling and for seeding as here specified
 - 2 Preliminary Grading Perform preliminary grading in such a manner as to anticipate the final grade Excess soil shall be redistributed before the application of fertilizer and mulch
- B Fine Grading Fine grading consist of bringing all ground areas to uniform slopes, meeting grades of installed curbs paving, etc , and drainage at a 2% slope unless otherwise indicated by the Drawings The finish grade is the ground surface grade after all loosening soil conditioning fertilizing and planting has been completed Accurate flow lines shall be set by instrument to points of drainage flow Finish grade in all areas (unless otherwise noted) shall be 1 1/2 inches below paving or curbs
- C Fertilizing
 - 1 All Seeding and Erosion Controlled Areas After soil has been brought to a rough finish grade, apply the following per 1 000 square feet of area and till into the top four (4) inches
 - 6 cubic yards of organic amendment
 - 30 lbs of 6 20 20 commercial fertilizer
 - 15 lbs of iron sulfate

3 2 SEEDING

Seeding shall follow as closely behind the tilling of the soil as necessary to make special seed bed preparation unnecessary

Seeding will not be permitted when wind velocity is such as to prevent uniform seed distribution. No application shall be undertaken during inclement weather. No application shall take place in the presence of free surface water or when the ground is frozen or untilled.

3 3 CLEAN UP

Upon completion of all landscape operations the project site shall be cleaned of all debris material and equipment. All such materials and equipment shall be entirely removed from the project site. All pavements shall be swept or washed clean upon completion of work.

3 4 MAINTENANCE

A General Maintenance and watering shall begin immediately after each portion of landscaping is completed, and shall continue for at least 5 weeks after completion of Phase IIB construction or until the seed establishment period is completed. Seed establishment period shall be that period necessary to achieve 75% coverage with no bare spots larger than 4 square feet. Coverage is based on the number of live seedlings per square foot.

The Contractor will maintain seeded areas as required to bring grass to an acceptable stand. Maintenance fertilizer 16 6 8 at the rate of 6 pounds per 1 000 square feet shall be applied after the first 30 days of the maintenance period has passed, and shall be watered in with a thorough irrigation.

B Watering

The Contractor shall be responsible for maintaining and watering native seeding areas for a period of five weeks after the time of seeding. Sprinkling of the seeded areas shall be carefully done in such a manner to avoid standing water, surface wash or scour. Areas seeded and maintained shall be protected against damage by vehicle and pedestrian traffic by the use of barriers and appropriate warning signs.

Seeded areas shall be watered at the following rates:

| <u>Time Period</u> | <u>Application Rate Per Acre</u> | <u>Estimated gal./acre</u> |
|------------------------|--------------------------------------|--------------------------------|
| Week 1 | 2 in | 5200 |
| Week 2 | 2 in | 5200 |
| Week 3 | 2 in | 5200 |
| Week 4 | 1 in | 2600 |
| Week 5 | 1 in | <u>2600</u> |
| <u>Total gal./acre</u> | | <u>20,800 gal.</u> |

Should watering be necessary beyond the initial five weeks Contractor is to continue watering at 1 in or 2.6 M gal per week through the seed establishment period

SECTION 03100--CONCRETE FORMWORK

PART I GENERAL

1 1 RELATED WORK SPECIFIED ELSEWHERE

- A Section 03200, Concrete Reinforcement
- B Section 03350, Concrete

1 2 APPROVALS All concrete formwork complete and in place shall be approved by the Buyer before concrete is placed

PART II PRODUCTS

2 1 FORMS

- A Forms for all surfaces shall be made of surfaced lumber, plywood or material that will provide a surface at least equal to surfaced lumber or plywood
- B Forms for all exposed surfaces shall be constructed of plywood or an approved equal Plywood for forms shall be of the grade Exter or B B (concrete form) conforming to the latest Product Standard for Soft Plywood, Construction and Industrial, of the National Bureau of Standards
- C Plywood panels shall be not less than 5/8 in thick
- D Plywood less than 5/8 in thick otherwise conforming to the requirements specified herein may be used with a continuous backing of 3/4-in sheeting
- E Metal forms shall be approved by the Buyer

2 2 MISCELLANEOUS MATERIALS

- A Form Coating A colorless mineral oil similar to Horn's form film
- B Form ties shall be adjustable in length and be so constructed that no metal will be within 1 in of finished surfaces after form removal Wire ties shall not be used where the concrete will be exposed to weathering or to view

PART III EXECUTION

3 1 DESIGN REQUIREMENTS Formwork shall be designed and erected by the Contractor in accordance with the American Concrete Institute (ACI) Recommended Practice for Concrete Formwork (ACI Standard 347) and in accordance with the following

- 1) Forms shall conform to the shape lines, and dimensions of members as called for on the drawings and shall be substantial free from surface defects and sufficiently tight to prevent leakage of concrete
- 2) Forms shall be properly braced or tied together to maintain position and shape under load
- 3) Joints shall be leakproof and arranged vertically
- 4) Lumber previously used in forms shall have nails withdrawn, and surfaces to be exposed to concrete shall be cleaned before reuse
- 5) Forms shall be so placed as to be readily removable without hammering or prying against the concrete

3 2 CORNER FORMS All vertical and horizontal corners to be exposed when forms are removed shall have a 3/4 X 3/4-in minimum chamfer unless indicated otherwise on the drawings

3 3 COATING

- A Apply two coatings of form oil to forms before placing concrete
- B After application remove surplus oil from forms and before placing concrete remove all oil from reinforcing steel

3 4 REMOVAL OF FORMS AND FALSE WORK

- A Leave false work and forms in place under structural slabs beams and girders for 14 days after the day of the last pour except
 - 1) When high early strength cement is used forms for all structures may be removed after 2 days
 - 2) In cold weather, this length of time shall be determined by the Buyer utilizing test cylinders cured under jobsite conditions
- B Remove all other forms in not less than 12 hr

3 5 FILLING HOLES Holes remaining from bolts or form ties or rods shall be filled solid with cement mortar All excess mortar at face of filled holes shall be struck off flush

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART I GENERAL

1 1 RELATED WORK SPECIFIED ELSEWHERE

- A Section 03100 Concrete Formwork
- B Section 03300 Cast in Place Concrete

1 2 DELIVERY AND HANDLING

- A Deliver steel reinforcement in an undamaged condition and store away from drainage ways and vehicular traffic
- B Handle reinforcement in a manner that will avoid bending or permanent deforming of the bars

1 3 SUBMITTALS Submit the following in advance of fabrication

- A Shop Drawings Submit shop drawings for reinforcing steel prepared in accordance with ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures Show layouts bending diagrams assembly diagrams dimensioned types and locations of all bar laps and splices and shapes dimensions, and details of bar reinforcing and accessories Include layout plans for bar supports and chairs, with typical details

PART II PRODUCTS

2 1 MATERIALS

- A Reinforcement Bars Conform to American Society for Testing and Materials (ASTM) A 615, Grade 60
- B Mesh Reinforcement Conform to ASTM A 185

PART III EXECUTION

3 1 DESIGN Reinforcing details shown on the Drawings shall govern the furnishing fabrication and placing of reinforcement Construction shall conform to the following requirements

- A Quantities and placement of reinforcement shall be in accordance with American Concrete Institute Standard 318 and the Manual of Standard Practice of the Concrete Reinforcing Steel Institute

B Splices

- 1 Splices of bars shall be made only where shown on the plans or as approved by the Buyer Where bars are spliced they shall be lapped at least 30 bar diameters unless otherwise shown on the Drawings
- 2 Splicing shall be accomplished by placing the bars in contact with each other and wiring them together
- 3 Welding of reinforcing steel will not be permitted unless specifically authorized by the Buyer

3 2 PLACING OF REINFORCEMENT

- A Before placing thoroughly clean all reinforcement of rust dirt mill scale or coatings and other material which would reduce the bond
- B Reinforcement appreciably reduced in section shall not be used
- C Following any substantial delay in the work previously placed reinforcement left for future bonding shall be inspected and cleaned
- D Do not bend or straighten reinforcement in a manner that will injure the material
- E Heating of reinforcement for bending or straightening will not be permitted
- F Torch cutting of reinforcing steel will not be permitted
- G Reinforcement shall be accurately placed and securely tied at all intersections and splices with 16 gage black annealed wire and shall be securely held in position during the placing of concrete by spacers chairs and approved supports

END OF SECTION 03200

SECTION 03300
CAST IN PLACE CONCRETE

PART I GENERAL

1 1 RELATED WORK SPECIFIED ELSEWHERE

- A Section 03100 Concrete Formwork
- B Section 03200 Concrete Reinforcement

1 2 APPROVALS

- A Obtain written approval from the Buyer before placing concrete
- B Obtain approval for each individual pour or structure

1 3 DESIGN CRITERIA

- A The design of the concrete mix that is the exact proportion of cement aggregates additives, and water shall be the responsibility of the Contractor
- B The proposed mix shall be submitted for approval 10 working days prior to placing concrete

1 4 ENVIRONMENTAL REQUIREMENTS

- A Temperature Do not place concrete unless the atmospheric temperature in the shade is above 40 degrees F and rising (except as noted below)
- B Weather Do not place concrete in rainy weather
- C Cold Weather Concreting
 - 1 Obtain permission from Buyer before doing any cold weather concreting
 - 2 Perform concrete work in accordance with American Concrete Institute (ACI) Standard 306 when the mean daily temperature is 40 degrees F or there is a danger of the temperature falling below 32 degrees F

PART II. PRODUCTS

2 1 MATERIALS

A Cement

- 1 Portland Cement Conform to American Society for Testing and Materials (ASTM) C150, Type I or Type II
- 2 Air Entraining Portland Cement Conform to ASTM C150 Type IA low alkali
- 3 High Early Strength Portland Cement Conform to ASTM C150 Type III

B Aggregate

- 1 Aggregate for Regular Weight Concrete Conform to ASTM C33
- 2 Aggregate for Lightweight Concrete Conform to ASTM C330
- 3 Coarse aggregate shall be 3/4 to 1 1/2 in maximum size

C Water Clean and potable

D Admixtures

- 1 Air Entraining Conform to ASTM C260
- 2 Obtain approval for use of admixtures (except air entraining)

E Expansion Joint Material

- 1 For vertical application use self expanding cork or sponge rubber conforming to ASTM D1752
- 2 For horizontal application use nonextruding asphalt impregnated fiber material conforming to ASTM D1751

F Curing Materials

- 1 Water Proof Paper Conform to ASTM C171 Type I or Type II

2 Polyethylene Sheeting Minimum 4 mils thick white color

3 Curing Compound Conform to ASTM C309 Type 2 having a white pigmented base

G Non Shrink Concrete

1 All non shrink concrete shall contain one (1) pound of Embeco Aggregate per pound of water that is in excess of two gallons per sack of cement

2 2 PROPORTIONING OF CONCRETE

A Concrete shall be proportioned in accordance with ACI Standard 301 to attain the required design strength

B Air entrainment shall be used in concrete for all structures that will be exposed to freezing and thawing

C The concrete shall have a slump appropriate for the selected work Slump shall not be less than 1 in nor greater than 4 in except as authorized by the Buyer

D Concrete shall be designed to develop the minimum compressive strength as shown on the Drawings When the compressive strength is not indicated on the Drawings it shall be a minimum of 4 000 PSI at 28 days

2 3 MIXING OF CONCRETE

A Concrete shall be mixed in accordance with ACI Standard 301

B Transit mixed concrete shall be mixed and delivered in accordance with ACI Standard 304

C When necessary for proper control of concrete mixing of transit mixed concrete shall be done at site of concrete placement

PART III EXECUTION

3 1 PREPARATION FOR PLACING CONCRETE

A Remove water and mud from excavation

B Remove hardened concrete wood chips ice and other debris from the interior of forms

- C Oil or wet forms just prior to placing concrete
- D Notify other crafts so they may deliver anchors for other work Obtain their assistance in setting anchors if required
- E Moisten absorptive foundations against which concrete will be placed

3 2 PLACING CONCRETE

- A Concrete shall be placed in accordance with ACI Standard 301
- B Concrete shall be placed in forms within 60 min from the time of introduction of cement and water
- C Do not retemper concrete
- D Deposit concrete as close as practicable to its final position Do not drop concrete more than 5 ft
- E Place concrete in continuous horizontal layers the depth of each layer shall not exceed 12 in

3 3 MECHANICAL AGITATION

- A Immediately after depositing compact the concrete by means of mechanical vibrators Slabs may instead be compacted by means of grid tampers when approved by the Buyer
- B Vibrator shall be flexible electric type or approved compressed air type
- C Do not place vibrator against reinforcing or forms or use vibrator to transport concrete within forms

3 4 FINISHING CONCRETE

- A Smooth Finish Give smooth finish to all exterior concrete surfaces, except slabs, that will be exposed to view
 - 1 Thoroughly wet and then brush coat surfaces with cement grout (one part Portland cement to two parts fine aggregate mixed with water to consistency of thick paint)

- 2 Spread grout with sponge or wood float to fill all pits and surface irregularities
 - 3 Scrape off excess grout and rub surface with burlap to remove visible grout film
 - 4 In hot weather keep grout damp by means of fog spray during the setting period
- B Rubbed Finish Give rubbed finish to interior concrete surfaces except slabs that will be exposed to view
- 1 Give smooth finish as specified above then rub with carborundum stones and water
 - 2 Do not use mortar or grout during rubbing
 - 3 Remove excess mortar that is worked up during rubbing
- C Monolithic Slab Finish Give monolithic finish to interior floor slabs
- 1 Compact fresh concrete and screened to required elevation
 - 2 Float to a true even plane with no coarse aggregate visible
 - 3 After surface moisture has disappeared, steel trowel floor slab to a smooth, even finish, free from trowel marks
- D Broomed Finish Give broomed finish to all trading surfaces of docks walks and steps exterior to the building
- 1 Give monolithic finish as specified above, except immediately after steel troweling brush surface with a stiff bristle brush
 - 2 Brush in parallel strokes at right angles to the normal flow of traffic
- E Slab Flatness Tolerances Finished cast in place slabs shall not vary more than 1/8 in from a 10 ft straightedge

3 5 CURING

Protect concrete against loss of moisture for at least 7 days by using one of the following methods for the surfaces indicated

A Vertical Surfaces and Under Surfaces of Beams and Elevated Slabs

- 1 Moist cure with forms in place for the full curing period or
- 2 Cover with wet burlap, or
- 3 Fog spray

B Slabs Ongrade and Floor Slabs

- 1 Cover with water proof curing paper or polyethylene sheet, lapped 4 in at joints and sealed with tape or
- 2 Cover with burlap or cotton mats and keep such covering continuously wet

C Exterior Walks, Docks, and Stairs

- 1 Apply curing compound in a two coat continuous operation using a minimum of 1 gal per 200 ft² for each coat Apply second coat at right angles to direction of first coat or
- 2 use method indicated in paragraph A above
- 3 Do not use curing compound on concrete surface to which future concrete will be bonded

3 6 PATCHING

- A Immediately after removal of forms, remove all fins and loose material
- B Chip out to solid concrete all honeycomb, aggregate pockets, and voids over 3/4 in in diameter
- C Fill chipped holes with epoxy mortar or neat cement grout Finish holes flush to adjacent surfaces
- D Damp cure patchwork for 72 hr

3 7 FIELD QUALITY CONTROL

A Sample Taking

- 1 Preparation of concrete samples and testing of such samples shall be the responsibility of the Buyer
- 2 The Contractor shall provide assistance in obtaining concrete samples
- 3 The Buyer may take three test cylinders from each placement of 50 yd³ or fraction thereof

B Compression Tests

- 1 Test cylinders shall be made in accordance with ASTM C31 and tested in accordance with ASTM C39
- 2 One cylinder will be tested at 7 days one at 28 days, and one retained as a spare

- C Slump Tests Slump of concrete shall be determined at point of discharge from the mixer in accordance with ASTM C143

END OF SECTION 03300

SECTION 03600

GROUT

PART I GENERAL

1 1 DELIVERY AND STORAGE

Store all grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer

PART II PRODUCTS

2 1 GROUT

- A Composition shall be one part Portland cement and three parts sand
- B Add water to create a stiff mixture
- C Minimum compressive strength shall be 1 500 PSI at 28 days
- D Discard grout not placed after 1 1/2 hr

PART III EXECUTION

3 1 GROUTING

- A Pack grout tightly around well casings pipe or conduit in penetrations through masonry or concrete walls
- B Smooth exposed surfaces of grout to blend with adjacent surfaces

END OF SECTION 03600

SECTION 03601

NONSHRINK GROUT

PART I GENERAL

- 1 1 DELIVERY AND STORAGE Store all nonshrink grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer

PART II PRODUCTS

2 1 MATERIALS

- A Nonshrink grout for setting column bases anchor bolts equipment and other items shown on the Drawings shall be one of the following types

1 EMBECO (premix) As manufactured by Master Builders Company

2 Ceilcote 648 As manufactured by The Ceilcote Company Inc

- B Adhesive for Ceilcote Grout Ceilcote 348 Adhesive Fast Set as manufactured by The Ceilcote Company Inc

- C Portland Cement Conform to American Society for Testing Materials (ASTM) C150 Type I

- D Sand Conform to ASTM C33 Fine Aggregate

- E Pea Gravel Conform to ASTM C33 Coarse Aggregate graded so that at least 90% passes 3/8 in sieve and 90% is retained by a No 4 sieve

2 2 MIXES

- A EMBECO Grout

1 For less than 2 in clearances or where size or shape of space makes grouting difficult use standard EMBECO grout and water

2 For greater than 2 in clearances where coarse aggregate will not obstruct free passage of the grout use EMBECO grout with 3/8 in aggregate (premixed)

3 Use the minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding After the grout has been mixed do not add more water for any reason

- B Ceilcote Grout Mix according to manufacturer s instructions
- C Portland Cement Mortar for Raked Out Edges of EMBECO Grout one part Portland cement two parts sand and 0.50 parts water by weight

PART III EXECUTION

3.1 FORMWORK

- A Build leakproof forms that are strong and able to withstand grout pressures
- B Provide enough clearance between the formwork and the area to be grouted to permit proper placement of grout

3.2 SURFACE PREPARATION

- A Clean concrete surfaces to be grouted of all defective concrete dirt oil grease and other foreign matter
- B Lightly roughen the concrete
- C Remove grease and foreign materials from all steel surfaces in contact with grout
- D Align level and maintain final positioning of all components to be grouted
- E Saturate all concrete surfaces with clean water remove excess water and leave none standing

3.3 PLACING

- A Place nonshrink grouting quickly and continuously by the most practical means permissible pouring pumping or under gravity pressure Do not use either pneumatic pressure or dry packing methods without written permission from the Buyer
- B Where practical apply grout from one side only to avoid entrapping air
- C Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment
- D Do not remove leveling shims for at least 48 hr after grout has been placed
- E After the EMBECO grout has reached initial set rake out all exposed edges approximately 1/2 in into the grouted area and point with cement sand mortar or grout

3 4 CURING

Cure grout for 3 days after placing by keeping wet and covering with curing paper or by another approved method

END OF SECTION

SECTION 05500

STRUCTURAL AND MISCELLANEOUS STEEL

PART I GENERAL

1 1 REQUIREMENTS OF REGULATORY AGENCIES

- A The design detailing fabrication and erection of steelwork shall conform to American Institute of Steel Construction (AISC) Specification for the Design Fabrication and Erection of Structural Steel for Buildings "
- B Welding shall conform to American Welding Society (AWS) Structural Welding Code Steel, D1 1

1 2 QUALIFICATIONS

- A Welding procedures welders welding operations and trackers shall be qualified in accordance with AWS Code D1 1
- B Submit to the Buyer the names of welders to be employed in the work together with approved certification

1 3 SUBMITTALS

- A Shop Drawings
 - 1 Submit shop drawings indicating all shop and erection details, including cuts, copes, connections holes, threaded fasteners rivets, and welds
 - 2 All welds both shop and field shall be indicated by AWS "Welding Symbols A2 4
- B Erection Procedure Submit descriptive data to illustrate the structural steel erection procedure including the sequence of erection and temporary staying and bracing
- C Manufacturer s Literature Submit description of each type of welding stud and arc shield
- D Submit manufacturer's installation requirements for drilled anchors

1 4 PRODUCT HANDLING

- A Deliver anchor bolts and other items to be set in concrete or masonry in ample time before need
- B Store steel members above ground on platforms or skids

PART II. PRODUCTS

2 1 MATERIALS

- A Steel Shapes, Bars, and Plates Conform to American Society for Testing and Materials (ASTM) A36
- B Galvanizing Conform to ASTM A123, A386 and ASTM Recommended Practices A384 A385
- C Metal Arc Electrodes Conform to ASTM A233 AWS A5 1
- D Fasteners and Anchors
 - 1 Standard Bolts and Nuts ASTM A307 Grade A
 - 2 High Strength Threaded Fasteners ASTM A325
 - 3 Rivets ASTM A502 Grade 1
 - 4 Anchor Bolts Conform to Section 1 3 ASTM A 307
 - 5 Drilled Anchors Hilti fastening systems or ITT Phillips Red head anchors
 - 6 Piston Drive Anchors and/or Powder Actuated Anchors Hilti fastening systems

2 2 FABRICATION

- A General
 - 1 Connections shall be as indicated on the drawings Connections not indicated shall be made in accordance with AISC Specification for the Design Fabrication and Erection of Structural Steel for Buildings
 - 2 All cutting of metal shall be true to the lines required and all burrs and sharp edges shall be removed

- 3 Holes shall be cut punched or drilled at right angles to the surface of the metal and shall not be enlarged by burning Holes in base plates or bearing plates shall be drilled

B Welding

- 1 Welded construction shall conform to AWS Code D1 1

C Painting Do not paint steelwork to be encased in concrete All other steelwork shall be given one coat of shop paint as follows

- 1 Clean steelwork by hand wire brushing or by other methods of loose mill scale, loose rust weld slag or flux deposit dirt and other foreign matter Remove oil and grease deposits with solvent
- 2 Prime steelwork with one coat of oil base rust inhibitive metal primer
- 3 Parts inaccessible after assembly shall be given two coats of shop paint as specified above
- 4 Where practical do not prime surfaces that are to be welded after erection If painted remove paint before field welding at least 2 inches beyond either side of the joints After welding field paint to match adjacent surfaces

PART III EXECUTION

3 1 ERECTION OF STRUCTURAL STEEL

A Bolting

- 1 Protect bolt heads from damage during erection
- 2 Provide bolts installed on beveled surfaces with beveled washers to give full bearing to bolt heads and nuts
- 3 Provide bolts of lengths that will extend entirely through but no more than 1/4 inch beyond the nuts Draw nuts tight against the work Upset threads after tightening to prevent loosening

- 4 High strength bolting shall conform to the AISC Specification for Assembly of Structural Joints Using High Strength Steel Bolts
- B Anchor Bolts Preset into built in work by using templates or other means necessary to accurately locate these items
- C Drilled anchors as per manufacturer s instructions
- D Base plates and bearing plates requiring grouting
 - 1 Support and align on steel wedges or shims Cut wedges and shims off flush with edge of base and leave in place
 - 2 After the supported members have been positioned plumbed and anchor nuts tightened grout the entire bearing area as specified in Section 03600 Grout
- E Alignment
 - 1 After assembly align and adjust the various members of a completed frame or structure before final fastening
 - 2 Fasten the splices of compression members after abutting surfaces have been brought completely into contact
 - 3 Before assembly clean and remove burrs from bearing surfaces and from surfaces that will be in permanent contact
 - 4 Correct poor matching of holes by redrilling to the next larger size Do not weld for redrilling or burn unfair holes to correct for poor matching of holes
 - 5 As erection progresses secure the work to take care of all dead loads wind and erection stresses until permanent connections are completed
 - 6 Tighten field bolts and leave in place unless removal is required in which case fill holes flush with plug welds
- F Drift pins may be used to bring parts into alignment but do not use in a manner that will distort or damage the metal

- G Do not use a gas cutting torch in the field for correction of fabrication errors unless written approval has been obtained from the Buyer

3 2 FIELD QUALITY CONTROL

- A The Contractor shall perform the following

- 1 Qualification of field welding procedures and personnel
- 2 Inspection of erected structural steelwork for conformance with the requirements specified
- 3 Witness and approve all anchor installations

- B Inspection of field assembled high strength bolted construction shall be in accordance with Section 6, AISC Specification for Structural Joints

- C Inspection of welds shall be in accordance with Section 6 of AWS Code D1 1

END OF SECTION 05500

SECTION 07900--CAULKING AND SEALANTS

PART I GENERAL

1 1 LOCATION Apply sealant around the following locations

- 1) Door frames and thresholds
- 2) Expansion joints
- 3) Roofing penetrations, collars, and flashings
- 4) Elsewhere as shown on the drawings

1 2 DELIVERY AND STORAGE OF MATERIALS

- A Deliver and store materials in original packages until ready to use
- B Store in a manner that will prevent damage by water, freezing, breakage, or contact with foreign materials

PART II PRODUCTS

2 1 MATERIALS

- A Silicone Sealant Silpruf one part primerless silicone sealant as manufactured by General Electric
- B Silicone Sealant--Construction 1200, one part primerless high modulus sealant as manufactured by General Electric
- C Backup Rod
 - 1 Backup rod shall be an extruded flexible, compressible poly ethylene foam designed for backup of elastomeric cold applied sealants
 - 2 Diameter 25% to 50% greater than the joint width
- D Bond Breaker -Polyvinyl chloride electrical tape with adhesive back
- E White Oakum- Twisted jute packing to commercial standards, embedded with bentonite
- F Sealants Shall be tested according to UL 723 Test for Surface Burning Characteristics

PART III EXECUTION

3 1 PREPARATION

- A Surfaces of joints to be sealed shall be clean, dry, and free from oil, dirt frost and foreign matter

- B Use backup rod for wide joints when recommended by manufacturer of sealant
- C Ambient temperature shall be between 40 and 100 F when sealant is applied
- D Thoroughly wash concrete and masonry surfaces to remove soluble alkaline salts
- E Clean metal surfaces of corrosion by wire brushing or using chemical cleaners

3 2 APPLICATION

A General

- 1 Sealant shall be uniformly smooth and free of wrinkles
- 2 Apply sealant sufficiently convex to result in a flush joint when dry
- 3 Follow manufacturer's recommendations

B Door Frames

- 1 Apply sealant bead around frames in concrete or masonry walls
- 2 Gaps larger than 1/2 in between frame and opening shall be grouted in by other trades

C Thresholds

- 1 Set metal thresholds in sealant bed at least 1/8 in thick
- 2 Secure threshold in place with minimum of three expansion screws
- 3 Remove excess sealant around edges

D Expansion Joints--Clean joints, apply bond breaker and apply silicone sealant

3 3 CLEANUP Clean all sealant from adjacent surfaces

END OF SECTION

SECTION 07901--PIPE PENETRATIONS

PART I GENERAL

1 1 LOCATION Apply caulking or sealant as follows at pipe, duct and conduit penetrations, exterior and interior walls, ceilings floor slabs penetrations between contaminated and uncontaminated zones and as noted unless otherwise shown on the contract drawings

1 2 DELIVERY AND STORAGE OF MATERIALS

A Deliver and store materials in original packages until ready to use

B Store in a manner that will prevent damage by water, freezing, breakage, or contact with foreign materials

PART II PRODUCTS

2 1 MATERIALS

2 1 1 Caulk 3M Brand Fire Barrier Caulk CP-25

2 1 2 Silicone Foam- Dow Corning 3 6548 Silicone RTV Foam

2 1 3 Polyurethane Sealant For floors use Vulkem 45 as manufactured by Mameco International, one part, pourable primerless self leveling sealant gray in color and conforming to Federal Specification TT S-00230 C, Type 1 (Class A)

2 1 4 White Oakum- Twisted jute packing to commercial standards imbedded with bentonite

2 1 5 Pipe Sleeve- Schedule 40 galvanized pipe or fabricated from zinc coated steel sheet having a nominal weight of not less than 1.656 psf Length shall be sufficient to pass through the entire thickness of the wall and/or floor

2 1 6 Conduit Seal -Fitting shall be EZS horizontal or EYS vertical seal fitting as supplied by Crouse Hinds

a Sealing compound shall be a Chico A as supplied by Crouse-Hinds

b Packing fiber shall be Chico X as supplied by Crouse Hinds

PART III EXECUTION

3 1 PENETRATION METHODS

3 1 1 New Concrete Walls

Cast sleeve in place Sleeve sizing shall be one inch larger than electrical conduit, pipe or air duct dimension Square or rectangular

duct sleeves shall be of sufficient wall thickness and temporarily braced to prevent distortion during casting period

3 1 2 Existing Concrete Walls

Core drill for conduit or pipe or saw cut hole for rectangular duct, a minimum of 1 in larger than electrical conduit pipe or air duct dimensions

3 1 3 New and Existing Masonry Block Walls (with cells grouted solid)

Same as "Existing Concrete Walls, paragraph 3 1 2

3 1 4 New and Existing Masonry Block Walls (with hollow cells)

Core drill or saw cut for sleeve Sleeve sizing shall be as described in paragraph 3 1 2

3 1 5 New Concrete Floors (other than floors on grade)

Cast sleeve in place Sleeve sizing shall be as described in paragraph 3 1 1

3 1 6 Existing Concrete Floors (other than floors on grade)

Core drill to the nearest common hole diameter or saw cut to accommodate sleeve Sleeve hole shall be a minimum of 1 in larger than electrical conduit pipe or air duct sleeve

3 1 7 Light-Gage Metal Walls and Permanent Type Ceilings

Core drill or saw cut to match outside dimension of electrical conduit pipe, or air duct

3 1 8 Banker Partitions and Suspended Ceilings

Core drill or saw cut for conduit, pipe, or air duct Sealing is not required

3 1 9 Light Gage Metal Stud Walls

Core drill or saw cut for sleeve Pipe or duct sleeve sizing shall be as described in paragraph 3 1 1 Flanges are required on both ends of finished wall surfaces Attach flanges with through bolts

3 2 SURFACE PREPARATION

3 2 1 Surfaces to be sealed shall be clean dry, and free from oil, dirt frost, and foreign matter Fresh concrete to be sealed shall have cured for at least 7 days prior to application of caulk or sealants

3 2 2 Ambient temperature shall be above 40 F and below 100 F when sealant is applied

3 2 3 Clean all metal surfaces of corrosion by wire brushing or using chemical cleaners

3 3 SEALING METHODS

Two methods are given for each condition. Either method is acceptable. Special effort shall be made to concentrically locate and seal conduit, pipe or duct in sleeve.

3 4 NEW CONCRETE WALLS

3 4 1 The space between the electrical conduit, pipe or air duct and the sleeve shall be firmly packed with white oakum and sealed on both ends with a minimum depth of 1 in. caulk.

3 4 2 The space between the electrical conduit, pipe, or air duct and the sleeve shall be dammed at both ends and sealed with silicone foam per manufacturer's recommended procedures.

3 5 EXISTING CONCRETE WALLS

3 5 1 The space between the electrical conduit, pipe or air duct and the core drilled or saw-cut hole shall be firmly packed with white oakum and sealed on both ends with a minimum depth of 1 in. caulk.

3 5 2 The space between the electrical conduit, pipe or air duct and the core drilled or saw-cut hole shall be sealed with silicone foam per manufacturer's recommended procedures. No sleeve required.

3 6 NEW AND EXISTING MASONRY BLOCK WALLS (with cells grouted solid)

Same as paragraph 3 5 Existing Concrete Walls

3 7 NEW AND EXISTING MASONRY BLOCK WALLS (with hollow cells)

3 7 1 The space between the electrical conduit, pipe, or air duct and sleeve shall be firmly packed with white oakum and sealed on both ends with a minimum depth of 1 in. caulk.

3 7 2 The space between the electrical conduit, pipe or air duct and the sleeve shall be sealed with silicone foam per manufacturer's recommended procedures.

3 7 3 The space between the sleeve and the drilled or cut hole shall be filled solid with nonshrink grout.

3 8 NEW CONCRETE FLOORS (other than floors on grade)

The space between the electrical conduit, pipe or air duct and the sleeve shall be firmly packed with white oakum and sealed on both ends with a minimum depth of 1 in. polyurethane sealant or caulk.

3 9 EXISTING CONCRETE FLOORS (other than floors on grade)

3 9 1 The space between the electrical conduit, pipe or air duct and the sleeve shall be firmly packed with white oakum and sealed on both ends with a minimum depth of 1 in polyurethane sealant or caulk

3 9 2 The space between the sleeve and the drilled or cut hole shall be filled solid with nonshrink grout

3 10 LIGHT GAGE METAL WALLS

Seal between electrical conduit, pipe, or air duct and drilled or cut opening with a 1/4 in bead of caulk

3 11 PERMANENT TYPE CEILINGS

Seal between electrical conduit pipe, or air duct and drilled or cut opening with a 1/4 in bead of caulk

3 12 LIGHT GAGE METAL STUD WALLS

3 12 1 The space between the electrical conduit, pipe or air duct and the sleeve shall be firmly packed with white oakum and sealed with a minimum of 1 in deep of caulk

3 12 2 The space between the electrical conduit pipe or air duct and the sleeve shall be sealed with silicone foam per manufacturer's recommended procedures

3 12 3 The space between the flange and wall shall be sealed with 1/4 in bead of caulk

3 13 SEALANT/CAULK APPLICATION

3 13 1 Sealant/caulk shall be applied uniformly smooth and free of wrinkles

3 13 2 Apply sealant/caulk sufficiently convex to result in a filled joint that is flush after the sealant has cured

END OF SECTION

SECTION 09900

PAINTING

PART I. GENERAL

1 1 QUALITY ASSURANCE

A Include on label of containers

Manufacturer's name
Type of paint
Manufacturer's stock number
Color
Instructions for application
Paint analysis

B Field Quality Control

- 1 Request review of first finished room space or item of each color scheme required by Buyer for color texture and workmanship
- 2 When required by Buyer paint surface not smaller than 50 ft² as project standard for selected types of paint

1 2 SUBMITTALS

A Furnish test samples of materials when required by the Buyer

B Color Samples

- 1 Submit color samples or charts from which final colors shall be selected by the Buyer
- 2 Colors indicated in the paint schedule shall be matched as closely as possible

C Submit proposed paint and color schedule for approval including for each item

Surface to be painted
Type of paint
Special thinners required, if any
Color
Special surface preparation required

1 3 REPAIR OF DAMAGE TO EXISTING FACILITIES All damage to paint systems of existing facilities which occur during execution of Phase IIB construction shall be repaired

1 4 PRODUCTS DELIVERY AND STORAGE

A Delivery of Materials Except for locally mixed custom colors deliver materials in sealed containers with labels intact and legible

B Storage of Materials

1 Paint materials and related equipment shall be stored outside of the building in the area assigned by the Buyer

2 The Contractor shall provide storage facilities adequate to protect the paint materials and equipment from inclement weather. The storage facilities shall have adequate ventilation. During cold weather, the storage facilities shall be heated to not less than the minimum recommended by the paint products manufacturer and at no time shall the temperature be below 35 degrees F

3 At the end of each work day, all paint materials shall be removed from the work area and properly stored

4 The Contractor shall obtain approval from the Buyer for all paint storage facilities used at the jobsite. All storage facilities used on the jobsite will be subject to inspection at any time by the Buyer's fire inspector

1 5 JOB CONDITIONS

A Environmental Conditions

1 Comply with manufacturer's recommendations for environmental conditions under which coatings and coating systems can be applied

2 Do not apply finish in areas where dust is being generated

3 Provide adequate ventilation when using flammable or toxic paint materials

B Protection

1 Cover or otherwise protect surfaces not being painted

2 Furnish fire retardant protective coverings. Do not use flammable material for protective coverings unless special permission is obtained from the Buyer

1 6 REFERENCE STANDARDS

A Rocky Flats Plant Standard No SC 110

PART II PRODUCTS

2 1 MATERIALS

- A Materials selected for painting systems for each type of surface shall be the products of a single manufacturer
- B Other products not specified but required for the job shall be first line products designed for the intended use

2 2 COLORS Colors of paints shall match color chips selected by the Buyer

2 3 MIXING AND TINTING

- A Deliver paints ready mixed to jobsite
- B Accomplish job mixing and job tinting only when acceptable to the Buyer
- C Using tinting colors recommended by manufacturer for the specific type of finish

PART III EXECUTION

3 1 INSPECTION

- A Examine surfaces scheduled to receive paint for conditions that will adversely affect execution permanence, or quality of work and which cannot be put into an acceptable condition through preparatory work
- B Do not proceed with surface preparation or coating application until conditions are suitable and approved by the Buyer

3 2 PREPARATION OF SURFACES

- A Truck Loading Dock Containment Area
 - 1 All new concrete surfaces must be allowed to cure at or above 70 F for at least 28 days prior to application of coating system
 - 2 Remove all non degraded form release agents form oils wax and grease by scraping off heavy deposits and solvent cleaning or washing with a hot biodegradable alkaline detergent solution followed by a water rinse Scrape or grind all fins and protrusions flush with surface
 - 3 Abrasive brush blast all concrete surfaces to remove laitance and solid contaminants

- 4 Blasting shall be performed sufficiently close to the surface to open up surface voids bugholes air pockets and other substrate irregularities but so as not to expose underlying aggregate Dry oil free air must be used in the blasting operation
- 5 All dust and blasting debris dust shall be removed by vacuuming Cloths shall not be permitted for cleaning blasted surfaces because of possible lint contamination Brushing or blowing the surface shall not be permitted, as these methods will not dislodge all particles embedded in the surface profile

3 3 APPLICATION

- A Apply paint with suitable brushes, rollers or spraying equipment
 - 1 Do not exceed rate of application recommended by paint manufacturer for type of surface involved
 - 2 Keep brushes rollers and spraying equipment clean dry and free from contaminants
- B Comply with recommendation of product manufacturer for drying time between succeeding coats
- C Vary slightly the color of successive coats Tinting shall be uniform
- D Sand and dust between each coat to remove defects visible from a distance of 5 ft
- E Finish coats shall be smooth free of brush marks streaks, laps or pileup of paints, and skipped or missed areas
- F Inspection
 - 1 Do not apply successive coats until each completed coat has been inspected and approved by the Buyer
 - 2 Only inspected coats of paint will be considered in determining the number of coats applied
 - 3 Defective or improper previous coatings shall be removed or corrected to the satisfaction of the Buyer
- G Make edges of paint adjoining other materials or colors clean and sharp with no overlapping
- H Apply primer on all work before glazing

- I Refinish whole wall where portion of finish has been damaged or is not acceptable
- J Spot coat all damage to existing facilities which occurs during construction, as specified herein with coating systems as specified under painting systems and schedules

3 4 CLEANING

- A Touch up and restore finish where damaged
- B Remove spilled splashed or splattered paint from all surfaces
- C Do not mar surface finish of item being cleaned

3 5 PAINTING SYSTEMS AND SCHEDULES

A Painting Systems

- 1 Paint System One (PS One) for the inside of the Truck Loading Dock containment area except sump and splash pad or top of containment wall

Dry Film Mills

- | | | |
|---|--|---------|
| a | Prime Coat Series 61 5002 Beige Tneme Liner (spray and backroll) | 4 0 6 0 |
| b | Patch Coat Series 63 1500 Filler & Surfacer (apply to large surface voids & bugholes) | |
| c | 2nd Coat Series 61 5002 Beige Tneme Liner (rolled) Applied for non skid surface by mixing with Unimin Corp Granusil #30/40 at mixture ratio of 5 lbs /gallon | 6 0 8 0 |
| d | 3rd Coat Series 61 5001 Gray Tneme Liner (spray apply) | 6 0 8 0 |

TOTAL (excluding Filler Silica
& Surfacer) 16 0 22 0

- 2 Paint System Two (PS Two) for the inside of the truck loading dock containment area sump and splash pad on top of containment wall

- a Horizontal Surfaces Overkote Plus mixed and applied per manufacturers instructions $\frac{1}{4}$ thickness

b Vertical and inclined Surfaces Overkote Plus V
mixed and applied per manufacturers instructions
1/8 thickness

B Paint Schedules (all colors will be selected by the Buyer when
not specified in the following schedules)

- 1 Truck Loading Containment Area interior surfaces except
sump and splash pad on top of containment wall PS One
- 2 Truck Loading Dock sump and splash pad on top of
containment wall PS Two

END OF SECTION 09900

SECTION 13000
COLLECTION WELL

PART I GENERAL

- 1 1 DESCRIPTION This section covers the furnishing and installing of the collection well, construction materials and the general method of construction. The collection well is a shallow extraction well and shall be constructed to the dimensions as shown in the Drawings. The well is approximately 20 feet in total depth from top of pitless adapter to bottom of well casing. The well will use a pitless adapter which will be fitted with a stainless steel continuous slotted well screen to the depth shown. The pitless adapter and casing will be installed in a 36 inch diameter well boring. The bottom 5 feet of unslotted casing shall be placed below the bedrock level and grouted as shown on the Drawings. The annular space between the well boring and the well casing shall be filled with a gravel filter packing as determined by the method outlined herein.
- 1 2 SUBMITTALS Contractor shall submit Shop Drawings, catalog data and descriptive literature of all items in accordance with requirements described in Division 1 of these Specifications. Specifically, the Contractor shall submit information on the pitless adapter, well screen selected and gradation of selected filter pack material.

PART II PRODUCTS

2 1 MATERIALS

- A Pitless Adapter The pitless adapter shall be as manufactured by Baker Monitor Division, type PS or equal and shall have a one year warranty period. The adapter shall accommodate an 8 inch stainless steel connection to the well screen described in paragraph 2 1 B.
- B Well screen The well screen shall be of the continuous slot type fabricated from type 304 stainless steel as manufactured by Johnson Filtration Systems or equal. The screen shall have a nominal diameter of 8 inches and a maximum slot size of 0.02 inches. It shall be the responsibility of the Contractor to assure that a minimum of 85 percent of the filter pack material as defined in paragraph 2 1 C will be retained by the selected well screen. The terminal portion of the well casing, the unslotted portion, shall be of type 306 stainless steel and shall be fitted with a threaded end cap.
- C Filter pack The filter pack material shall consist of clean, washed, uniformly graded sand material meeting the

following specification The filter pack material shall be determined by taking the finest grain size anticipated to be retained (that passing a U S Standard Sieve size 100) and multiplying it by 6 This size shall be the 70 percent retained grain size of the filter pack material used The uniformity coefficient (the size sieve that retains 40 percent of the sample divided by the size sieve that retains 90 percent) shall not be greater than 2.5 The gradation of the filter pack material shall form a smooth and gradual size distribution curve when plotted The Contractor shall ensure that the well screen openings will retain a minimum of 85 percent of the filter pack material

PART III. EXECUTION

3.1 INSTALLATION

- A The well shall be constructed using a boring or drilling method as determined by the Contractor The well boring shall be approximately 36 inches in diameter and extend to the soil bedrock interface as determined in the field by the Buyer or their appointed representative During and immediately after the boring or drilling operation, the Contractor shall provide a sonotube or other acceptable means of preventing sloughing of the soil wall into the boring This protection shall remain in place until the filter pack material is placed After the 36 inch boring is complete a smaller approximately 12 inch diameter boring shall be made in the center of the 36 inch boring extending approximately 6 feet into the bedrock The unslotted portion of the casing shall be placed into this smaller boring and the annular space between the casing and the boring grouted in place The grout material shall be placed using a tremie tube with a minimum diameter of 2 inches It is recommended that the entire well assembly be placed as a unit (unslotted portion with end cap, slotted screen portion connection to adapter and pitless adapter) to enable proper alignment The well assembly shall be secured in proper alignment and the annular space between the 36 inch boring and the well screen filled to the elevation shown with filter pack material The filter pack material shall be placed using a tremie tube The sonotube or other soil retention means shall be withdrawn as the filter pack material is placed The remaining upper portion of the boring shall be grouted as shown on the Drawings All material excavated from the boring shall be disposed of in accordance with the provisions of Section 02200
- B The installation of the pump motor, pump shroud, power cables and level sensing element shall be in accordance with the manufacturer's recommendations and at the elevations as shown on the Drawings

- C The well will be developed using pumping. Because of the expected low production of the well, it is anticipated that pumping for a continuous period will not be possible; therefore, developmental pumping will consist of periodic pumping over a period of time to be determined by the Buyer and negotiated with the Contractor. All water from well development shall be delivered via the influent pipeline or trucked to the influent storage tanks for treatment.

END OF SECTION

SECTION 15050

EQUIPMENT INSTALLATION

PART I GENERAL

- 1 1 DESCRIPTION This Section covers the relocation moving installation alignment grouting leveling and testing of the equipment as shown on the Drawings
- 1 2 QUALITY ASSURANCE The Contractor shall be responsible for providing all lifting skidding jacking roller equipment and labor to install the equipment
- 1 3 SUBMITTALS The Contractor shall furnish to the Buyer a general arrangement drawing showing necessary moving equipment which will be used in installing the equipment The Contractor shall furnish upon request of the Buyer necessary proof that the moving equipment is in a safe operating condition and that the moving equipment is capable of handling the loads to be imposed upon it The Contractor shall furnish the Buyer the procedure of which the equipment shall be moved

PART II PRODUCTS

- 2 1 MATERIALS General The Contractor shall furnish and install adequate leveling plates blocks dowels and shims Plates and blocks shall be steel plate stock with sheared edges Stock may be flame cut All shim and dowel stock shall be cold drawn steel Dowels shall be straight with provisions for pulling

PART III EXECUTION

3 1 EQUIPMENT INSTALLATION

- A General Equipment both Contractor and Buyer furnished shall be installed and fastened as indicated on the Drawings complete with all appurtenances in place aligned tensioned (V belt trans) grouted tested and ready for operation

- B Workmanship

- 1 After moving equipment into place the Contractor shall carefully uncrate assemble and install the equipment

All work shall be performed by skilled qualified mechanics working at their trade under experienced supervision Equipment shall be completely assembled and all work shall be the product of first class workmanship Any defective or unsatisfactory installation work shall be corrected by the Contractor at the Contractor's expense

- 2 Packing material shall be removed from the premises and disposed of as directed by the Buyer

C Lifting and handling

- 1 All lifting and handling shall conform to OSHA safety practices All handling and positioning techniques employed including lifting skidding and jacking shall be performed in a manner that will avoid subjecting the equipment to undue flexure and stress Hooks and slings shall not be attached in any manner that can possibly result in bending damaging or breaking any part of the equipment Lifting attachments shall be provided as required for lifting and setting in place and shall be approved by the Contractor
- 2 Pallets cradles and skids shall be used wherever necessary to safely handle equipment Lifting eyes and lugs provided on the equipment shall be used in making lifts Any saddles spreader beams or other special lifting equipment required shall be provided by the Contractor
- 3 Any damage to the equipment which was not present prior to installation shall be repaired by the Contractor at no additional cost to the Buyer

D Foundation Preparations All caulking and dirt shall be removed from the anchor bolts and sleeves for freedom of movement The surfaces of the foundation shall be cleaned with water before grouting The Contractor shall make no adjustments to anchor bolts except as directed or approved by the Buyer

E Grouting Grouting shall be in accordance with Section 03300 and the manufacturer s instructions using nonshrink grout

F Leveling All equipment specified in room shall be precision leveled as described below and as set forth in the American Society of Mechanical Engineers B5.16 Standard All other equipment shall be set true and level

- 1 Equipment to be set true and shall be leveled both in the longitudinal and axial direction with a 36 in carpenter s level These levels shall be approved by the Buyer
- 2 Equipment which requires precision leveling shall be leveled within 0.0005 in in 12 in in two directions using a four way Fells precision level The level shall be located on the work table surface or on the longitudinal ways and cross sideways as applicable The leveling surfaces shall be clean and free of nicks and

burrs At least three repeat readings shall be taken without an intervening failure, rotating the level 180 degrees between readings The Buyer shall observe the readings and will record the readings on each machine

- G Operational Check All spindles drive motors and accessory equipment such as fans pumps vacuum units etc are to be checked for proper rotation and operation before equipment is placed into service
- H Touchup Paint Surfaces of equipment installed hereunder which are damaged or scratched during installation shall be properly repaired and repainted to match existing paint used on the machine The Contractor shall furnish all materials and labor required to accomplish this purpose

END OF SECTION 15050

SECTION 15060

PIPING AND APPURTENANCES

PART I. GENERAL

1 1 DESCRIPTION Contractor shall furnish all tools equipment materials and supplies including all labor required for complete installation testing and flushing of piping and appurtenances all as shown on the Drawings and specified herein

1 2 SCOPE OF WORK

A Work Included in This Section The Work of this Section shall include the furnishing, installation and testing of pipe, pipe supports, fittings, specials, thrust blocks, and all required appurtenances as shown on the Drawings and as required to make the entire piping system operable

1 3 CONTRACTOR SUBMITTALS

A General Shop and Erection Drawings, together with other required information specified shall be submitted in accordance with the requirements of Division 1 of these Specifications and the requirements specified in this Section

B Shop Drawings Shop Drawings, complete with material grade, and class for all pipe, fittings and couplings and for all joints coatings and appurtenances shall be submitted Detailed catalog and engineering data sheets shall be submitted for all components and a proposed schedule for delivering and installing the piping shall be included

C Erection Drawings

1 General Complete Erection Drawings for all buried and exposed piping shall be submitted The drawings shall show and identify the pipe, pipe joints, fittings, couplings joint harnesses, wall sleeves with sealant and backup thicknesses wall castings hangers, saddles straps and other supports and miscellaneous details

2 Buried Piping Erection Plans and Profile Drawings for all buried pipe shall show the following information

a Location length wall thickness and type of joint for each pipe section and fitting to be furnished and installed

- b Pipe axis station and elevation at all changes in gradient or horizontal alignment,
- c Within the limits of a horizontal or vertical curve provide the station and invert or center line elevation to which each pipe joint will be laid
- d Provide the combined horizontal and vertical joint deflection at each horizontal and vertical curve or bend

3 Exposed Piping Erection and Elevation Drawings for all exposed piping shall show the location of the pipe, joints and couplings critical clearances, orientation of valves, spacings of hangers and supports, and the location and size of anchor bolts

D Erection Procedure The Installation Drawings shall be supplemented with a set of written procedures for performing the field piping installation. The procedures shall cover in detail the preparation and making of the push on, mechanical, flanged welded, calked flared, fusion welded, chemically welded and screwed joints and couplings measures to ensure integrity of interior pipe lining and exterior protective coating at all joints and couplings the method of backing up and sealing the annular spaces in pipe sleeves and the installation and adjustment of pipe hangers and other supports

E Protective Coating A protective coating schedule shall be submitted, showing shop and field surface preparations, materials, methods of application, dry thicknesses and tests for defects

F Testing Procedures Procedures for testing the piping, and arrangements for obtaining and disposing of water for the tests shall be fully described. The equipment for testing shall be itemized. Details of bulkheads, flanges, or caps for the testing of the pipe shall be included with the submittal

1.4 PRODUCT HANDLING, DELIVERY AND STORAGE

A General Pipe shall at all times be handled with equipment designed to prevent damage to the interior or exterior coating of the pipeline

B Shipping When making shipments all chains, cables and hold down equipment shall be carefully padded where in contact

with the pipe For steel pipe, when the deformation is projected to exceed one percent of the diameter each end of the pipe shall be properly braced with approved interior supports or spiders

C Unloading Unloading from the trucks shall be done with care No pipe shall be allowed to fall from trucks Pipe shall only be unloaded using a crane or fork lift

D Gaskets Gaskets shall be stored in containers or wrappers which will protect the gaskets from ozone and other atmospheric deterioration

1 5 DRAWINGS For purposes of clarity and legibility the Drawings are essentially diagrammatic to the extent that many offsets, bends, and special fittings and exact locations are not indicated Contractor shall carefully study the Drawings and determine for himself the extent of the Work and include in his bid all necessary bends fittings and specials to install the Work in conformance with the Contract Documents

1 6 REFERENCE STANDARDS

A Rocky Flats Plant Standard No s SP 211 SP 220, SP 301, and SC 107

B ANSI Section B 31 3

PART II PRODUCTS

2 1 GENERAL

A General Requirements All pipe fittings, couplings and appurtenant items shall be new free from defects or contamination, and wherever possible, shall be the standard product of the manufacturer They shall be furnished in pressure or thickness classes as specified or shown Unless otherwise indicated the size shown shall be the nominal pipe diameter

B Length All pipe shall be furnished in a maximum of 20 foot lengths unless indicated otherwise

C Raised Face Flanges When carbon steel or stainless steel flanges or flanged valves with raised face will be bolted directly to flat faced FRP plastic or cast iron flanged

fittings or valves, the raised face shall be removed or spacers approved by the valve or pipe manufacturer shall be installed to allow bearing over 100 percent of the flange area

D See Table I for types of joints

E Pipe Schedule Pipe materials shall conform to the piping schedule included within this Section

2 2 CHLORINATED POLYVINYL CHLORIDE SCHEDULE PIPE AND FITTINGS Pipe and fittings shall conform to the following requirements

A Chlorinated Polyvinyl Chloride Pipe Chlorinated Polyvinyl Chloride Pipe shall conform to the requirements of ASTM F441 Type IV Grade I Schedule 80 Class 23447 B in accordance with ASTM D1784

B Chlorinated Polyvinyl Chloride Pipe Fittings Fittings shall conform to the requirements of ASTM Designation F439 for socket type fittings

C Joints in CPVC Pipe and Fittings Joints shall be the solvent welded socket or flanged type Flanges where shown shall be 150 pound and shall be of the same material as the pipe Solvent weld joint shall comply with ASTM F493

D Bolts Bolts for use with PVC flanges shall be steel, AISI Type 303 conforming to the requirements of ASTM Designation A320 79a

E Gaskets Gaskets for flanged joints shall be constructed of gylon For other applications gaskets with a Teflon envelope with high polymer chloride resin core are acceptable

2 4 DOUBLE WALLED CONTAINMENT PIPING Containment piping shall be made from copolymer polypropylene material which conforms to ASTM D2146 The Asahi/American Proline double containment piping system or approved equal shall be used The inside pipe nominal size shall be 2 inches and the outside pipe nominal size shall be 4 inches Installation shall conform to Proline Engineering Design Guide Installation Practices from Asahi/America or installation practices of alternate manufacturer Transitions between containment piping and CPVC shall be made by flanges or by threaded slip joint plastic adapter or fitting No plastic pipe shall be threaded

2 7 PIPE HANGERS AND SUPPORTS Pipe hangers, brackets, saddles clamps, and other supports shall be adjustable type shall have ample strength and rigidity to resist the hydraulic thrusts at changes in

direction and at dead ends as well as the dead weight loads and the load carried, and shall be hot dip galvanized, including all bolts nuts, and threaded parts Where not specifically identified or called out on the Drawings, computations showing adequacy of Contractor selected hangers and supports to meet these requirements shall be submitted with the Shop Drawings Hangers and supports so identified on the Drawings does not relieve the Contractor from meeting all requirements specified herein Wherever possible brackets shall be used in lieu of hangers

A General Hangers and supports shall include all hanging and supporting devices of metallic construction shown specified, or required for pipe lines, apparatus, and equipment other than electrical equipment The Contractor's working drawings, as required herein shall show the quantity type design and location of all hangers and supports required under the various Contract items Hangers and supports shall be painted the same as required for the supported piping

1 Where specified or shown, bolts stud bolts, rods, stainless, and nuts of hangers and supports shall be of steel Bolts shall not be less than 1/2 inch diameter unless otherwise called for on the Drawings

2 Except where otherwise shown specified, or required, hangers, supports, anchors and concrete inserts shall be the standard types as manufactured by Elcen Co , Grinnell Co , Fee and Mason Manufacturing Co or equal meeting the requirements specified herein Unless otherwise approved by the Buyer, all hangers, supports, and concrete inserts shall be listed with the Underwriters' Laboratory

3 All hangers support stands saddles supports and anchors will be designed to withstand a seismic event according to RFP Standard SC 106 latest revision, for Important Low Hazard

B Design Hangers and supports shall be adequate to maintain the pipe lines, apparatus, and equipment in proper position and alignment under all operating conditions and have springs where necessary Hangers and supports shall be of standard design where possible and be best suited for the service required as approved by the Buyer Where required they shall be screw adjustable after installation Supporting devices shall be designed in accordance with the best practice and shall not be unnecessarily heavy Sufficient hangers and supports shall be

installed to provide a working safety factor of not less than 4 for each hanger, assuming that the hanger is supporting 12 feet of pipe filled with water. On pipes 3 inches in diameter and larger which are covered with heating insulation, hangers and supports shall include proper pipe protection saddles. Hangers and supports shall be designed to resist all induced thrusts and lateral loads as required for seismic design.

- 1 Hangers and supports shall be designed and selected in accordance with MSS Standard Practices SP 58, Pipe Hangers and Supports Materials and Design, and SP 69, Pipe Hangers and Supports Selection and Application

C Supports for CPVC Piping Rigid plastic piping normally shall be supported by the same type of hangers used with steel pipe, except that in no instance will C clamp, or other point bearing supports be allowed. Riser clamps, if required, shall be full circumferential type only. Support spacing shall be based on the plastic pipe manufacturer's recommendations for the service conditions but not more than 5 feet on center. Flexible plastic tubing or rigid plastic pipe operating at temperatures high enough to lower its strength shall be supported continuously by light metallic angles or channels and special hangers.

D Saddle Stands Saddle stands shall be of adjustable type. Each stand shall consist of a length of wrought pipe fitted at the base with a standard screw threaded cast iron flange and at the top with an adjustable saddle or roll. The base flange shall be bolted to the floor or foundation. Stanchions shall be of similar construction to the saddle stand, except that they shall be fitted at the top with cast iron pipe saddle supports or with pipe stanchion saddles with yokes and nuts. Where adjustable supporting devices are not required, pipe lines 3 inches in diameter and smaller may be supported on approved cast iron malleable iron, or wrought steel hooks, hook plates, ring or ring plates.

E Anchors Anchors shall be furnished and installed where specified, shown, or required for holding the pipe lines and equipment in position or alignment. Anchors shall be designed for rigid fastening to the structures either directly or through brackets. The design of all anchors shall be subject to approval by the Buyer.

- 1 Anchors for piping shall be of the cast iron chair type with wrought steel strap except where anchors form an

integral part of pipe fittings or where an anchor of special design is required

F Inserts Inserts for concrete shall be furnished galvanized and shall be installed in the concrete structures where required for fastening supporting devices They shall be designed to permit the rods to be adjusted horizontally in one plane and to lock the rod nut or head automatically Nail slots shall be provided in the exposed flanges of the insert Inserts shall be designed to carry safely the maximum load that can be imposed by the rod which they engage

G Materials No use shall be made of wire straps chains etc for supporting piping nor shall cast expansion shields be used for anchoring bolts Hangers and supports of metallic construction shall conform to the requirements specified herein and to the following standards

- | | | |
|---|-------------------------------------|--------------------|
| 1 | Structural steel | ASTM A36 and A283 |
| 2 | Steel bars (grade 1022) | ASTM A107 |
| 3 | Steel castings (grade N 1) | ASTM A27 |
| 4 | Iron castings (grade 35) | ASTM A42 |
| 5 | Cast iron pipe fittings (class 125) | ANSI B16 1 |
| 6 | Malleable iron castings | ASTM A47 |
| 7 | Bolting materials stainless steel | |
| | a Bolts stud bolts and nuts | ASTM A276 |
| | (type 316) | |
| | b Physical requirements | |
| | (1) Tensile strength | 75 000 psi minimum |
| | (2) Yield strength | 30 000 psi minimum |
| | (3) Elongation | 35 percent maximum |
| | (4) Reduction of area | 45 percent maximum |

8 Where specified or shown bolts stud bolts rods yokes and nuts of hangers and supports shall be of stainless steel as specified above with dimensions threads and

sizes equivalent to those specified in steel Where submerged in process fluids or where located in covered manholes, bolts stud bolts, rods, yokes and nuts of hangers and supports shall be of stainless steel, unless otherwise noted

H Supports for Piping Brackets for support of piping from walls and columns shall be made of welded wrought steel and shall be designed for three maximum loads classified as follows

| | | |
|---|--------|--------------|
| 1 | Light | 750 pounds |
| 2 | Medium | 1,500 pounds |
| 3 | Heavy | 3,000 pounds |

When medium or heavy brackets are bolted to walls back plates of adequate size and thickness shall be furnished and installed to distribute the load against the wall When used on concrete walls the back plates shall be cast in the concrete Where the use of back plates is not practicable the brackets shall be fastened to the wall in such a manner that the safe bearing strength of the wall will not be exceeded Pipe rolls or chairs shall be of the cast iron type Pipe rolls shall be provided with threaded rods

I Spacing of Hangers Maximum spacing of hangers or supports shall be 5 feet

J Where concentrations of valves, fittings and equipment occur, closer spacing of supports will be required In no case shall any total hanger load (weight of piping insulation and contents) exceed the following load carrying capacities for hot rolled steel rod ASTM A36 77a)

| Nominal Rod Diameter Inches | | Maximum Safe Load - Pounds Max Temp 650 F |
|--------------------------------|--|--|
| 1/2 | | 1,130 |
| 5/8 | | 1 810 |
| 3/4 | | 2,710 |
| 7/8 | | 3 770 |
| 1 | | 4,960 |
| 1 1/8 | | 6 230 |
| 1 1/4 | | 8 000 |
| 1 3/8 | | 9,470 |
| 1 1/2 | | 11 630 |

- 2 9 PIPE MATERIAL SCHEDULE The pipe material schedule is presented as Table 1 at the end of this Section Pipe shall be as indicated in the schedule unless otherwise shown on the Drawings or specified otherwise Pipe material listed therein shall conform to Specifications presented in Part II of this Section

PART III EXECUTION

3 1 GENERAL

- A Care and Handling of Materials All materials shall be carefully handled in all steps of fabrication, storing, loading, transporting, unloading storing at the site, and installation using the means and following the procedures submitted with the approved Shop Drawings Pipe slings used during handling and tie down straps during transit shall be not less than 4 inch wide flat fiber or plastic straps
- B Installation
- 1 The different kinds of piping (buried and exposed) shall be installed in accordance with the Drawings and the procedures and methods submitted with the approved Shop and Erection Drawings Such procedures and methods shall conform to or exceed the minimum requirement of the pipe manufacturer and shall be as supplemented by the provisions specified herein The interior of pipe, fittings and couplings shall be clean and free from contamination when installed and effective means shall be taken to prevent the entrance of foreign matter during progress of the work The types and sizes of pipes and fittings to be used shall be as specified herein and as shown on the Drawings Where fittings are omitted from the Drawings they shall be the same size as the piping and in all cases shall conform to the plumbing code requirements
 - 2 All pipe shall be carefully placed and supported at the proper lines and grades and where practicable shall be sloped to permit complete drainage Piping runs shown on the Drawings shall be followed as closely as possible except for minor adjustments to avoid architectural and structural features If relocations are required they shall be approved by the Buyer
- C Storage and Handling During storage handling, and transporting every precaution shall be taken to prevent injury

to pipe Pipe shall be handled only by means of approved hooks on ends of sections by means of fabric slings or other methods approved by the Buyer for the pipe used

- D Verification of Dimensions All dimensions essential to the correct location of the pipe or fit of piping at equipment and valves or to the proper location and orientation of pipe sleeves and wall castings or to the avoidance of obstructions or conflict with other improvements shall be accurately determined by the Contractor prior to fabrication of the piping involved All required changes from the nominal locations shown on the Drawings shall be made by the Contractor and shall be included as a part of the work hereunder and be approved by the Buyer
- E Pipe Sleeves All piping which will pass through walls slabs footings or beams shall be provided with specified pipe sleeves with annular space sealed or with wall castings The Contractor shall provide the wall sleeves and castings for insertion in the concrete work covered in Section 03300, Cast in Place Concrete and shall verify their correct setting prior to concrete placement The sleeve sealant shall be polyurethane caulking No pipe joint will be allowed to occur in the sleeve The seal on both ends of the sleeve shall be flush with the concrete surfaces on completion of work and drying of sealant Caulking and sealing of wall sleeves shall conform to the following requirements and Section 07900
- 1 Preparation for Sealing The annular space between the pipe and sleeve shall be cleaned of all loose particles and contamination and shall be dry prior to sealing Tape or other recommended protection shall be applied on the structure surfaces to preclude contamination by the sealant, and any contamination which occurs shall be removed immediately, followed by a thorough washing of the surfaces with solvent Prepared compound not used during the application time limits designated by the manufacturer of such compound shall be discarded
 - 2 Application of Compound Sealant The sealing shall be performed after any required primer has been applied and backup material placed The work shall be performed in accordance with the submitted Erection Drawing detail and procedure and all grooves shall be solidly filled The application shall be made in clean, straight lines free of wrinkles be tooled as required and finished with a

convex surface just sufficient to provide the required flush surface upon drying Work shall not be performed when the air temperature is below 50 degrees F

3 2 BURIED PIPING

- A Buried Pipe Installation Buried piping shall be laid to the grades and alignment shown on the Drawings, and all trenching bedding and backfilling shall conform to the applicable requirements of Division 2 other work shall conform to the following sections of AWWA Standard C600

Section 2 "Inspection, Receiving Handling and Storage ,

Section 3 1, Alignment and Grade ,

Section 3 3 Pipe Installation

Section 3 4 "Joint Assembly

Section 3 6 Valve and Fitting Installation ,

Section 3 8 Thrust Restraint

The foregoing requirements shall govern the work, regardless of the type of pipe installed unless a more stringent requirement is specified When the work is not in progress open ends of pipe and fittings shall be securely closed The piping shall be placed when trench and weather conditions are suitable No pipe shall be laid in water and responsibility for the diversion of drainage and dewatering of trenches during construction including meeting all safety and environmental requirements shall be borne by the Contractor All pipe in place shall be approved as to line grade bedding and proper joint construction before backfilling In all backfilling operations the Contractor shall be responsible for preventing damage to or misalignment of the pipe

- B Joint Installation Installation of joints and couplings for buried piping shall conform to the following requirements

- 1 Joints for pipe 4 inch diameter and over, shall comply with the supplementary requirements specified herein and joints of all sizes shall conform to the applicable requirements specified hereinafter for aboveground piping Care shall be taken to keep pipe in correct alignment when making joints Friction or lever pullers or other approved means of insuring straight pulling

shall be used on pipe where damage to the end might occur. The popping on of joints will not be permitted. The fitting of piping to valves, hydrants, and wall castings shall be worked out in advance of installation to ensure correct orientation of the mating ends and bedding of approach piping.

- C Coverage Unless otherwise shown on the Drawings, all buried piping shall have a coverage of at least 24 inches between the top of the pipe and the finished surface. Variations from the pipeline grade and alignment may be allowed to accommodate fabrication with the approval of the Buyer. All changes of grade shall require the approval of the Buyer on the Installation Drawings.

3.3 ABOVE GROUND PIPING

- A Pipe Installation All piping shall be installed in accordance with the Erection Drawings and the erection procedure submitted with the approved Shop or Erection Drawings. The horizontal piping shall be run parallel to the building walls and shall be level except where otherwise shown or specified. Parallel lines shall be grouped on the same horizontal or vertical plane wherever possible. Vertical piping shall be plumb, and the entire piping configuration shall allow adequate clearances for convenient access for painting and preventive maintenance of valves. Piping shall clear obstructions, preserve headroom, and keep openings and passageways clear. If structural difficulties or other work prevent the running of pipes or the setting of equipment at the point indicated on the Drawings, the necessary minor deviations therefrom, as determined by the Contractor and approved by the Buyer, will be allowed and shall be shown on the erection drawings to be furnished. Except as otherwise shown or specified, piping installation work shall conform to the requirements of the printed or written recommendations of the manufacturer of the product involved for the given conditions, as approved.

- B Joint Installation Installation of joints and couplings shall conform to the following requirements:

- 1 Joints and Couplings Joints and Couplings shall be made in accordance with the specified requirements made part of the erection procedure submitted by the Contractor.
- 2 Flanged Joints Flanged joints shall be made with gaskets centered in the joint. Bolts, studs, and nuts

shall be lubricated with graphite and oil so that the nuts can be turned by hand. Care shall be taken to prevent excessive initial tension to the bolt and studs and so that the tension applied is as nearly uniform as possible. The rust preventive compound applied to the faces of flanges before shipment shall be removed before installation.

- 3 PVC Pipe Joints at fittings and couplings to valves and equipment shall be made in accordance with the manufacturer's printed instructions.

3.4 INSTALLATION OF CHLORINATED POLYVINYL CHLORIDE SCHEDULE PIPE

- A Fittings Fittings for plastic pipe shall be as shown on Table I at the end of this section. Transition from plastic to steel pipe shall be by flanges or by threaded slip joint plastic adapter or fitting. No plastic pipe shall be threaded. No solvent shall be used on threaded end of plastic adapters or fittings.
- B Anchorage All line valves and fittings at downpipes shall be anchored to the wall in a manner to prevent stress and rotation of the pipe.
- C Joints Joining methods and materials for plastic pipe shall conform strictly to the printed recommendations of the pipe manufacturer. Solvent weld connections shall be made as follows:
 - 1 Joints shall be wiped clean and a solvent supplied by the manufacturer applied to both male and female connections.
 - 2 Two applications of the solvent shall be made.
 - 3 The treated surfaces shall be forced together as soon as the pipe material becomes soft or tacky and given 1/4 turn as recommended by the manufacturer.
- D Laying Pipe in Trench
 - 1 Bedding

The bottom of the trench shall be covered with 6 inches of pipe embedment material (see Section 02200) compacted to 90 percent of maximum density as determined by the

modified proctor testing method so as to provide the pipe with a firm and uniform bearing surface over the entire length of the pipe

2 Laying Pipe

- a The Contractor shall provide the necessary mason's lines and supports to ensure installation of the pipe in accordance with the Drawings Facilities for lowering the pipe into the trench shall be such that neither the pipe nor the trench will be damaged or disturbed
- b The Buyer shall inspect all pipe and fittings before they are installed and reject any piece that is damaged by handling or defective to a degree which will materially affect the function and service of the pipe
- c The Contractor shall take adequate measures to prevent the intrusion of foreign materials of any kind into the pipe or fittings At the end of each day's work the Contractor shall adequately plug any open ends of installed pipe and fittings in order to prevent the intrusion of foreign materials
- d The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform Lay pipe with perforated side down
- e Pipe shall not be installed on frozen, soft, or spongy subgrade material Pipe shall not be installed in standing water The Contractor shall furnish all necessary equipment and labor to properly dewater the trench as the need arises at the Contractor's cost
- f Pipe which is not reasonably true in alignment or grade or which shows any settlement after laying, shall be taken up and relaid without extra compensation to the Contractor
- g Pipe and fittings shall be joined in accordance with accepted industry practice

3 Backfill

- a The pipe zone shall be backfilled by hand by placing embedment material simultaneously on both side of the pipe for the full width of the trench in layers 6 inches in depth. Each layer shall be compacted to a compaction of not less than 90 percent of maximum density as determined by the Modified Proctor Testing Method. Care should be taken not to damage the pipe. The pipe zone is considered to extend to 6 inches above the top of the pipe.
- b Power, control, and instrumentation cable shall be installed in embedment material as shown on the Drawings.
- c Class I Structural Fill to within 1 foot of surface shall be placed in horizontal layers not in excess of 6 inches in thickness and shall have a moisture content such that the required compaction may be obtained. Each layer shall be compacted by hand or machine tampers or other suitable equipment to 90 percent of maximum density as determined by the Modified Proctor Testing Method. Orange tape shall be placed in the Structural Fill one foot above the electrical cables.
- d One foot of Topsoil shall be placed in horizontal layers not in excess of 6 inches in thickness and shall have a moisture content such that the required compaction may be obtained. Each layer shall be compacted by hand or machine tampers or other suitable equipment to 90 percent of maximum density as determined by the Modified Proctor Testing Method.

3 5 INSTALLATION OF PIPELINES THROUGH CONCRETE STRUCTURES

- A Whenever a pipeline or any material terminates or extends at or through a structural wall or sump, the Contractor shall install, in advance of pouring the concrete, the fitting or special casting required for the particular installation. Otherwise, prepare and submit Shop/Erection Drawings of other installation methods and obtain approvals in advance of commencement of work.

B Whenever any run of pipe is installed per approved Shop/Erection Drawings subsequent to placing of concrete the Contractor shall accurately position the opening in the concrete for such pipelines. Unless otherwise required all pipes penetrating fluid containing or earth supporting portions of the structure shall be ring flanged

1 Opening shall be of sufficient size to permit a perfect final alignment of pipelines and fittings without deflection of any part and to allow adequate space for satisfactory packing where pipe passes through wall to insure water tightness around openings so formed

2 The boxes or cores shall be provided with continuous keyways to hold the filling material in place and to insure a watertight joint

3 Boxes or cores shall be filled with nonshrink grout or nonshrink concrete

3 6 **CHANGES IN LINE AND GRADE** In the event that obstructions not shown on the Drawings are encountered during the progress of the work which will require alterations to the Drawings the Buyer shall have the authority to change the Drawings and order the necessary deviation from the line or grade. The Contractor shall not make any deviation from the specified line or grade without approval by the Buyer. Should any deviations in line or grade be permitted by the Buyer in order to reduce the amount of rock excavation or for other similar convenience to the Contractor, all additional costs for thrust blocks, valves, blowoff assemblies, extra pipe footage or other additional costs shall be borne by the Contractor

3 7 IDENTIFICATION OF PIPING

A Definitions

1 **Piping Systems** For the purpose of this section, piping system shall include fittings, valves, and piping accessories. Pipes are defined as conduits for the transport of gases and liquid

2 **Identification** Identification of piping system content (flow media) shall be a lettered legend giving the name of the contents in full (no abbreviations) as called out in the drawing legend

B Application

1 Location

- a** All exposed or concealed piping in finished or unfinished areas shall be identified. Underground piping shall be excepted.
- b** Identification and supplementary information legends shall be applied close to all valves, branches, changes in direction on both sides of each floor wall or barrier through which the line passes, every connection to equipment, and at a maximum of 20 ft intervals on straight runs of piping.

2 Method

- a** Pipes shall have identification clearly lettered with the aid of stencils. Stenciling shall be accomplished with paint materials only; tapes and "stick on" labels and materials are not permitted. Pipe not otherwise painted shall be painted with a white patch of sufficient length and width to receive the legends. Black stenciling shall always be used on white patches. Legends shall be clear, sharp, and legible.
- b** Pipe or coverings less than 3/4 in actual outside diameter shall have identification and supplementary information legends on 1/2 in wide aluminum tape such as DYMO, banded in place.

3 Orientation of Legends

Attention shall be given to the orientation and visibility of identification legends. The legends shall be arranged and located so as to be easily readable by a person standing on the floor or at the normal access location to the pipe. Stenciled legends shall generally be arranged parallel with the axis of the pipe.

4 Letter height shall be as follows

| Pipe or Covering Actual Outside Diameter | Height of Lettering |
|---|------------------------|
| 3/4 in to 1 1/2 in | 1/2 in |
| Over 1 1/2 in to 2 in | 3/4 in |
| Over 2 1/2 in to 6 in | 1 1/4 in |

3 8 PROTECTIVE COATINGS Painting and coatings shall conform to the applicable requirements of Section Painting and Protective Coatings and the schedule submitted with the Shop and Erection Drawings It shall be the Contractor's responsibility to fully coordinate the protective coating requirements with the foregoing color code identification requirements to ensure compatibility of materials used

3 9 TESTING The Contractor shall perform hydrostatic, leakage, and operational tests as specified herein The Contractor shall perform all excavation and other work required to locate and repair leaks and correct other defects which may be disclosed or develop under tests, the Contractor shall replace all coating painting, backfill, or other permanent work removed in locating or repairing leaks and correcting defective piping All gages and control devices connected to lines being tested must be disconnected for the duration of the test Water shall not be used in testing air lines chlorine lines, nitrogen lines or other gas carrying pipes High pressure air testing of PVC pipe in exposed or above ground installations is not permitted The Contractor shall furnish and install a chart type recording meter for the pressure tests The Contractor shall submit to the Buyer before and after the test the gage and meter used so that these devices may be tested by the Buyer

A Testing Requirements

1 Gravity Sewer Pipes or Other Pipelines Having Free Surface Flow Except Storm Drainage Pipelines Chlorinated Polyvinyl Chloride pipe (CPVC) having free surface flow shall be given a water exfiltration test as specified herein The Contractor has the option of using a low pressure air test in lieu of the water exfiltration test If excessive ground water is present which precludes use of the exfiltration test the Contractor shall use either the low pressure air test or infiltration test

- 2 Pressure Pipe Flanged or Welded Joints CPVC DWPP or other pipe material with solvent welded flanged or heat fused joints shall be pressure tested as specified herein No leakage shall be permitted

B Pressure Tests

- 1 General All piping including valves shall be field tested at a hydrostatic pressure of 1.5 times the pipe pressure class (unless specified otherwise in the Testing Schedule) corrected to the elevations of the test gage with duration of two hours minimum, for each pressure test except as otherwise requested by the Buyer Piping conveying liquids between process tankage, not subject to pumping shall be tested to the maximum possible pressure that can be obtained under static conditions Air piping shall be tested using air or nitrogen
- 2 Joint Exposure All exposed pipe fittings valves hydrants and joints shall be carefully inspected before being cast in concrete and/or during the open trench tests All defects discovered shall be corrected by removal and replacement, as approved by the Buyer and the work then retested to demonstrate satisfactory performance Where practical no concrete encasement or backfilling of pipe joints will be permitted prior to the satisfactory completion of the tests in any given section

C Leakage Tests

- 1 General Leakage tests shall be conducted concurrently with pressure test The lowest pressure during the leakage test shall be no less than 5 psi below the pressure used in the pressure test No leakage shall be permitted The duration of the test shall be not less than two hours and measurement shall be made by means of a calibrated suction tank showing the amount of water required by the test pump to accurately maintain the specified test pressure Tests shall be performed only in the presence of the Buyer or if scheduling of tests is such that the Buyer cannot attend due to conflicting commitment tests may be performed without the Buyer's presence if the Contractor obtains written permission to do so from the Buyer prior to initiation of testing No

test report will be accepted unless proof of compliance with the foregoing requirement accompanies the test report

3 10 FLUSHING

- A General All piping shall be flushed clean of all dirt and foreign material following completion of the hydrostatic and leakage test Air and gas piping shall be purged with air or inert gas as directed by the Buyer
- B Equipment and Supplies The Contractor shall provide all equipment, and supplies for performing the work, and shall waste the water at locations or by procedures approved by the Buyer The Contractor shall be responsible for furnishing fittings and all special pipe taps required for injecting any required sterilizing solution

- 3 11 DISINFECTION Disinfection of the chemical dilution water, plant water and potable water lines shall be performed in accordance with AWWA Standard C601

TABLE 1
PIPE MATERIAL SCHEDULE

| Service | Application | Size | Pipe Material | Joint and Fittings |
|----------|--------------|------------|---------------|--------------------|
| Influent | buried | 2 in /4 in | DWPP | butt weld/flange |
| | above ground | 2 in /4 in | DWPP | butt weld/flange |
| | containment | 2 in /4 in | DWPP | butt weld/flange |
| Effluent | buried | 4 in | CPVC | solvent weld |
| | exposed | 4 in | CPVC | solvent weld |

KEY

CPVC Chlorinated Polyvinyl Chloride
DWPP Double Wall Polypropylene

END OF SECTION 15060

SECTION 15099

PROCESS VALVES REGULATORS AND MISCELLANEOUS COMPONENTS

PART I. GENERAL

- 1 1 DESCRIPTION The Contractor shall furnish all tools equipment, materials, and supplies and shall perform all labor required to furnish and install all valves and appurtenances as indicated on the Drawings and specified herein
- 1 2 SCOPE OF WORK
 - A Work Included in This Section The Work of this Section shall include the furnishing installation, and testing of all valves and required appurtenances as specified herein, shown on the Drawings and as required to make the entire facility operable except for those valves and appurtenances required to be provided in other Sections of these Specifications
- 1 3 SUBMITTALS Provide the following in conformance with applicable requirements
 - A Shop Drawings Submit Shop Drawings for process valves, regulators and miscellaneous components Shop Drawings shall be complete with bill of materials showing kind and class of materials, and catalog and engineering data showing compliance with the specified requirements
 - B For each type and model of valve provide
 - 1 Assembly instructions and spare parts list, and
 - 2 Preventative/corrective maintenance instructions and
 - 3 Certificate of seat compatability with entailed fluid exposure
 - C Erection Drawings Erection Drawings shall include the procedures to be used in setting, supporting, and/or anchoring the valves, the fitting of line pipe to the valves for proper coupling, and for adjusting and testing all valve assemblies

- 1 4 VALVE SCHEDULE Valves shall be of the type shown on the Drawings and of the rating and construction as specified below All valves of the same type shall be of the same make unless otherwise approved

PART II PRODUCTS

2 1 CPVC VALVES

- A Ball valves shall be true union type with socket fittings All parts in contact with fluid shall be CPVC, teflon, or viton Pressure rated at 150 psi at 70 F minimum
- B Globe valves shall have socket fittings Pressure rated at 150 psi at 70 F minimum All parts in contact with fluid shall be CPVC teflon or viton
- C Ball check valves shall have socket fittings and union connections pressure rated at 150 psi at 70 F minimum and all parts in contact with fluid shall be CPVC viton, or teflon
- D Swing check valves shall have flange connectors clean out access pressure rated at 150 psi at 70 F and all parts in contact with fluid shall be teflon or CPVC

- 2 2 PRESSURE RATING All process valves shall be rated for a working pressure equal to or more than the pressure rating of the connecting piping unless specifically shown otherwise on the Drawings or specified in other Sections of these Specifications

PART III. EXECUTION

- 3 1 INSTALLATION Installation shall be in conformance with Sections 15060 and 15400 and the following requirements

- A Valves and Valve Boxes shall be set in true alignment and grade in accordance with the procedures submitted with the shop and erection drawings and the valves mounted as shown All adjustments and operating settings of valves and appurtenances shall be made in accordance with procedures and detailed instructions furnished with the Erection Drawings
- B Buried Valves shall be firmly supported in place by the foundations to preclude strain on the pipe connections The

valve boxes shall be checked for centering plumb over the wrench nut to ensure that the box cover is flush with the finish grade. Earth backfill shall be carefully tamped around each valve box to a distance of 4 feet on all sides of the box, or to undisturbed trench face if less than 4 feet. Valves shall have their interiors cleaned of all foreign matter before installation. The valves shall be inspected in opened and closed positions to ensure that all parts are in working condition.

- C Aboveground Valves shall be rigidly held in place using supports and hangers as shown on the drawings and as specified. The stem orientation of valves in elevated piping shall be as approved by the Buyer for accessibility but no valve shall have stem in the downward direction. Saddle type valve supports shall be provided for all valves in vaults. Supports shall be of rugged construction providing at least 120 degrees under support for the valve body. shall be constructed of steel as specified in Division 5 and shall be anchored to the foundations using galvanized anchor bolts.

3 2 TESTS

- A Field Tests. Test all valves and appurtenances for proper operating adjustments and settings and for freedom from vibration, binding, scraping, and other defects. The adequacy of all pipe hangers and supports and valve supports to meet specified requirements shall be verified. All defects found shall be corrected as approved.

- 3 3 COORDINATION WITH INSTRUMENTATION. It shall be the responsibility of the Contractor to coordinate with Division 17 regarding the requirements of control valves.

- 3 4 CLEANING. All valves and appurtenances shall be flushed clean of all foreign matter together with the piping as specified in other sections.

- 3 5 LABELING. After the painting, if required, of process piping is complete, the Contractor shall stencil the tag numbers of all valves numbered on the P and ID Drawings, on the pipe adjacent to the valve for pipe 2 inches and over. Characters shall be one inch high minimum and shall be oriented to be visible from the valve operating position. When the valve has extended operator shaft or chain operator, the number shall be placed both at the operating position and at the valve if the valve cannot be seen.

from the operating position The latter requirement does not apply if the valve is buried Valves in pipes under 2 inches shall have characters as large as the pipe will permit or at the Buyer s option, on an adjacent surface Characters shall be preferably white however if this would not provide sufficient contrast to the pipe the Buyer may select another color Paint used shall be of the same type and quality as used for painting the pipe

END OF SECTION 15099

SECTION 15140

PUMPS

PART I GENERAL

1 1 RELATED WORK SPECIFIED ELSEWHERE

- A Section 15060 Piping
- B Section 15099 Process Valves

1 2 SCOPE OF WORK

- A The work in this section shall include the furnishing, installation and testing of pumps and motors as shown on the Drawings

1 3 SUBMITTALS

The Contractor shall provide the following in conformance with applicable requirements in Division 1

- A Installation maintenance and operating instructions
- B Pump curves
- C Specifications of materials in contact with fluids being pumped

PART II PRODUCTS

2 1 COLLECTION SUMP AND WELL PUMPS

Collection well pump, (P100) and Sump 2 pumps (P103 & P104) shall be Grundfos model 5S05 13 or approved equal 1/2 HP, 3 15/16 wide, 1 2 to 7 GPM (5 GPM nominal) with stainless steel or fiberglass flow sleeve, 1 NPT discharge 480 volt, 3 phase The flow sleeve shall be designed per the pump manufacturer's recommendations to maintain a minimum cooling water velocity past the pump motor of 0 25 ft/sec when pumping 5 gal/min For a 3 15/16 diameter motor at 5 gpm the maximum inside diameter of the flow sleeve shall be 4 7

Sump 1 pumps (P101 & 102) shall be Grundfos model 16515 14 or approved equal 1 1/2 HP 3 15/16 wide 10 to 20 gpm (15 gpm nominal), with stainless steel flow sleeve 1 1/2" NPT discharge 480 volts 3 phase The flow sleeve shall be designed per the pump manufacturer's recommendation to maintain a minimum cooling water velocity past the pump motor when pumping 5 gal/min

PART III. EXECUTION

3 1 GENERAL

Contractor shall coordinate pump installation with other trades including concrete work process piping electrical and instrumentation Installation shall comply with Section 15050 Equipment Installation

3 2 INSTALLATION

Pumps shall be mounted and plumbed and electrical connections made as prescribed by the pump manufacturers

3 3 TESTING

Pumps performance shall be tested as recommended by the manufacturers

END OF SECTION 15140

SECTION 16010

ELECTRICAL

PART I GENERAL

1 1 GENERAL REQUIREMENTS

- A The installation shall apply as a minimum requirement with the applicable rules of the latest edition of the national Electrical Code (NEC) except where code requirements are exceeded as specified on the Drawings or in this Specification
- B All electrical materials shall be new and as listed by the Underwriters' Laboratories, Inc (UL) except as otherwise specified herein
- C The contract drawings indicate the extent and general arrangement of the conduit and wiring systems
- D No portion of the permanent wiring system shall be utilized until the final inspection is performed

PART II PRODUCTS

2 1 PRODUCT REQUIREMENTS All electrical equipment shall be suitable for operation at an altitude of 6 000 ft

PART III. EXECUTION

3 1 REPAIR OF EXISTING WORK The work shall be carefully laid out in advance Where any penetrations are necessary for the installation support or anchorage of the conduit, raceway, or other electrical work this work shall be carefully done Any damage to buildings piping or equipment shall be repaired at no expense to the Buyer

3 2 INSPECTION AND ELECTRICAL TESTS

- A The Contractor shall test under supervision of the Buyer or his designated representative all wiring and connections for continuity and grounds and when directed he shall demonstrate by Megger test the insulation resistance of any circuit or group of circuits Where such insulation resistance tests indicate the possibility of faulty insulation, the Contractor shall locate the point of fault, replace same with new material and demonstrate by further test the elimination of such fault
- B All grounds shall be tested and recorded in accordance with the Specifications by a double scale (0 30 and 0 300 ohms) Megger ground tester

- C All 480 V 3 phase branch circuits shall be given a Megger test before being put into operation The Contractor shall furnish the test equipment
- D Records of each inspection and test together with the complete data and readings associated therewith shall be entered on a form furnished by the Buyer for this purpose Test data taken and compiled during the inspections shall be certified by the Contractor and the Buyer witnessing the tests Records of the inspections and tests, together with the complete data on all readings taken shall be made and incorporated into a formal report by the Contractor
- E Test each outgoing feeder emanating from a switchgear, motor control center, or panel Open the feeder circuit breaker at the switchgear motor control center or panel Disconnect the feeder at the supply and load ends
 - 1 Make a Megger insulation test between A and B, B and C and the C and A phases
 - 2 Make a phase to ground Megger insulation test between the A phase and ground Repeat the test on the B and C phases
 - 3 The minimum acceptable insulation resistance shall be 15 megohms
- F After the interior wiring system installation is completed and at such time as the Buyer may direct the Contractor shall conduct an operating test for approval The equipment shall be demonstrated to operate in accordance with the requirements of this specification

END OF SECTION

DIVISION 16050
BASIC MATERIALS AND METHODS

PART I GENERAL

1 1 GENERAL REQUIREMENTS

- A The installation shall comply as a minimum requirement with the applicable rules of the latest edition of the National Electrical Code (NEC) except where code requirements are exceeded as specified on the drawings or in this specification
- B All electrical materials shall be new and as listed by the Underwriters' Laboratories Inc (UL), except as otherwise specified herein
- C The contract drawings indicate the extent and general arrangement of the conduit and wiring systems
- D No portion of the permanent wiring system shall be utilized until the final inspection is performed

1 2 REFERENCE STANDARDS

- A Rocky Flats Plant Standard No s SE 103 SE 104 SE 112 SE 114 and SC 107

PART II PRODUCTS

2 1 PRODUCT REQUIREMENTS All electrical equipment shall be suitable for operation at an altitude of 6,000 ft

2 2 CIRCUIT BREAKERS Circuit breakers for 120/208 V and 480 V shall be suitable for use in the panelboard or motor control center (MCC) in which they are installed Circuit breaker shall be new and UL listed

2 3 CONDUCTORS

- A General All conductors shall be sized according to the American wire gage (AWG) standard All conductors shall be copper All conductors shall be stranded Minimum size shall be No 14 Wire sizes No 14 and larger shall be sized at a conductor temperature rating of 60 C
- B Conductors shall be stranded 600 volt and Type THW type THWN Type XHHW or Type UF

C Other All conductors for other than general use shall be as specified on the drawings

2 4 CONDUIT AND FITTINGS

Use Robroy Industries Plastic Bond red PVC coated conduit with urethane interior coating for all electrical conduits

2 5 IDENTIFICATION

A The Contractor shall be responsible for identification and labeling of all electrical power equipment as required by the latest revision of RFP SE 104 Standard for the Identification of Electrical Power Systems Incorporated herein by Reference

PART III EXECUTION

3 1 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance Where any penetrations are necessary for the installation, support or anchorage of the conduit raceway or other electrical work this work shall be carefully done Any damage to buildings, piping or equipment shall be repaired at no expense to the Buyer

3 2 CIRCUIT BREAKERS

Any installation preparation inspection or performance requirements are included in Part II Refer to this section for applicable execution requirements The NEC shall be used as a minimum requirement

3 3 WIRE AND CABLES

A General

- 1 Wires and cables for power, lighting, and control shall, as far as practicable, be continuous from origin to destination without running splices in intermediate pull boxes or outlet boxes Slack shall be left in all pull boxes and sufficient slack at equipment to allow for neat workmanlike termination
- 2 A wire pulling lubricant must be used when pulling conductors If a pulling compound is used it shall be Minerallac pull in compound 100 or Ideal Yellow 77
- 3 All wires shall be color coded The following color code shall be followed explicitly

- a Electrical branch circuit and interior supply side circuit conductors shall be suitably color coded or otherwise labeled in such manner to be consistent with NEC requirements and with any existing color coding or labeling system used at the site for ungrounded circuit conductors. This coding or labeling shall identify voltage levels, the grounded conductors, the equipment grounding conductors and ungrounded single phase or polyphase conductors. The color coding for low voltage electrical systems shown below shall be used provided it does not conflict with existing color coding with color coded tape banding. Phase colors shall be

| | <u>120/208 240</u> <u>Volts</u> | <u>277 480</u> <u>Volts and Above</u> |
|-----------|------------------------------------|--|
| Phase 1 A | Brown | Black |
| Phase 2 B | Orange | Red |
| Phase 3 C | Yellow | Blue |
| Neutral | Gray | White |
| Ground | Green | Green |

Single phase circuit power conductors shall be color coded per phase as indicated. Neutral conductor shall be white or gray depending on system.

- b Motor control conductors (generally No 14) shall be multi conductor cables with the individual conductor color coded as per the drawings.
- c Grounding conductors shall be insulated and green in color.

B Splices and Terminations

- 1 In connecting wire and cable to equipment, various methods may be used depending upon the local condition. In general the use of solderless pressure connectors for terminals, taps and splices is recommended. Buchanan or Stakon PT series splices are acceptable on wire size up to 1/0 and for 1/0 and larger. Burndy KSV Servits shall be used.
- 2 Lugs may be T&B, Stakon or T&N method squeeze connector or Burndy Hi Press. All splices shall be made with solderless squeeze type connectors whenever possible.

- 3 All motor lead connections shall be made by bolting the lug of the motor lead back to back with the conductor lug, bolting together with proper size machine screws and using flat washers. Motor connections shall be covered with several layers of rubber and friction tape for vibrating equipment or Scotch No 33 for other equipment, then a shrink type cover applied.

3 4 CONDUIT AND FITTINGS

A Conduit

- 1 Conduit systems shall be installed in accordance with the applicable provisions of the NEC.
- 2 Conduits shall be concealed within the walls, ceilings, and floors where indicated and shall be kept at least 6 in from parallel runs of steam pipes or hot water pipes. Exposed runs of conduit shall be installed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings with right angle turns consisting of cast metal fittings or symmetrical bends. Bends and offsets shall be avoided where possible but when necessary, shall be made with an approved hickey or conduit bending machine. The use of pipe tee or vise for bending conduit will not be permitted. Conduit that has been crushed or deformed in any way shall not be installed. Crushed or deformed conduit shall be replaced at no cost to the Buyer at the discretion of the Buyer. Expansion fittings or other approved devices shall be used to provide for expansion where conduit crosses expansion joints.
- 3 Wooden plugs inserted in masonry or concrete wall shall not be used as a base to secure conduit supports. Conduit shall be supported on approved types of galvanized wall brackets, ceiling trapeze, or strap hangers. Expansion anchors shall be used in concrete or brick. Machine screws on metal surfaces and wood screws on wood construction. Nails shall not be used as the means of fastening boxes or conduits. Conduit shall be installed in such a manner as to prevent the collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps wherever possible. The Contractor shall exercise the necessary precautions to prevent the lodgment of dirt, plaster, or trash in conduit fittings and boxes during the course of installation. A run of conduit that has become clogged shall be entirely freed of these accumulations or shall be replaced. Conduit shall be securely fastened to all sheet metal outlet

junction, and pull boxes with galvanized locknuts and one bushing installed in accordance with standard practice. Care shall be observed to see that the full number of threads project through to permit the bushing to be drawn tight against the end of the conduit after which the locknut shall be sufficiently tightened to draw the bushing into firm electrical contact with the box.

- B Conduit Fittings Outlets shall be installed in the locations shown on the drawings. The Contractor shall study the general building plans in relation to the spaces surrounding each outlet in order that his work may fit the other work required. When necessary, the Contractor shall relocate outlets so that when fixtures or other fittings are installed, they will not interfere with other work or equipment. Only zinc coated or cadmium plated sheet steel boxes shall be used. Boxes shall be installed in a rigid and satisfactory manner, either by wood screws on wood expansion anchors on masonry or machine screws on steel work. One piece gang boxes not less than 2 in deep shall be utilized where necessary.

C Wall Penetrations

- 1 Conduit seals shall be used when routing conduit from a potentially contaminated (hot) area to a noncontaminated (cold) area. The seal shall be located on the potentially contaminated side.
- 2 Surfaces of joints to be sealed shall be clean, dry and free from oil, dirt, frost and foreign matter. Fresh concrete at joints to be sealed shall have cured for at least 7 days prior to sealing.
- 3 Ambient temperature shall be above 40 F and below 100 F when sealant is applied.
- 4 Clean metal surfaces of corrosion by wire brushing or using chemical cleaners.
- 5 Sealant shall be uniformly smooth and free of wrinkles.
- 6 Apply caulking sufficiently convex to result in a filled joint that is flush after the sealant has dried.
- 7 Clean all sealant from adjacent surfaces.
- 8 Follow manufacturer's recommendations.

- 9 Silicone sealant General Electric silicone white
 Silpruf sealant shall be installed in accordance with
 manufacturer s recommended procedure

3 5 IDENTIFICATION

- A Equipment to be identified includes but is not limited to
- 1 Disconnecting devices that are located in the area
 - 2 Control panels starters, pushbutton stations, and
 other control devices
 - 3 Receptacles
 - 4 Instruments and associated devices
 - 5 Conduit systems
- B Legends
- 1 The Contractor shall be responsible for electrical
 identification as directed in paragraph 2 5 of this
 section of these specifications

3 6 INSPECTION AND ELECTRICAL TESTS

- A The Contractor shall test under supervision of the Buyer or
 his designated representative all wiring and connections
 for continuity and grounds, and when directed, he shall
 demonstrate, by Megger test, the insulation resistance of
 any circuit or group of circuits Where such insulation
 resistance tests indicate the possibility of faulty
 insulation, the Contractor shall locate the point of fault
 replace same with new materials, and demonstrate by further
 test the elimination of such fault
- B All grounds shall be tested and recorded in accordance with
 the specifications by a double scale Megger ground tester
- C All 480 V 3 phase feeder and feeds shall be given a Megger
 test and rotation check before being put into operation
 The Contractor shall furnish the test equipment
- D Records of each inspection and test together with complete
 data and readings associated therewith shall be entered on
 a form furnished by the Buyer for this purpose Test data
 taken and compiled during the inspections shall be certified
 by the Contractor and Buyer witnessing the tests Records
 of the inspections and tests together with the complete
 data on all readings taken shall be made and incorporate
 into a formal report by the Contractor

E Meggar testing shall be conducted by the Contractor as follows

- 1 After installation and before connecting splicing or terminating a continuity check shall be performed on each wire
- 2 After installation and before connecting splicing or terminating, a Meggar test shall be performed on each insulated conductor used at voltages greater than 150 volts
- 3 Where Meggar testing is required the tests shall be made between one disconnected insulated conductor, and ground with all other conductors grounded Each insulated conductor shall be tested in the same manner The test shall be performed for at least 30 seconds using the 1 000 V setting on the Meggar The 100 megohms Any wire having a Meggar" reading lower than average by 50 percent or more, even though meeting the minimum requirements shall be replaced

F After the wiring system installation is completed and at such time as the Buyer may direct the Contractor shall conduct an operating test for approval The equipment shall be demonstrated to operate in accordance with the requirements of this specification

END OF SECTION 16050

SECTION 16150
ELECTRICAL POWER EQUIPMENT

PART I GENERAL

1 1 MOTORS

A Rating

| <u>Horsepower</u> | <u>Voltage</u> | <u>Phase</u> |
|------------------------|----------------|--------------|
| 1/2 to 150 (inclusive) | 230/460 | 3 |
| Less than 1/2* | 115/230 | 1 |

* All 3600 rpm motors and any requiring high starting torque or where the continuity of operation is vital shall be 460 V 3 phase

Motors smaller than 1/2 hp furnished on machine tools or other equipment having a 460 V main drive motor shall be as normally furnished by the manufacturer and shall include any accessories required to operate from the main power supply

B Enclosures All motors shall be open type unless otherwise specified

Motors shall be only one of the following, unless otherwise specified

- 1 Drip proof
- 2 Totally enclosed fan cooled (TEFC) or totally enclosed non ventilated (TENV) Where frame size and price are the same the nonventilated is preferred
- 3 Combination of any one of the above enclosures with a totally molded, vacuum impregnated, encapsulated winding

C Frames

All motor frames and end bells shall be National Electrical Manufacturers Association (NEMA) standard

D Bearings All motors shall have antifriction ball bearings unless otherwise specified except fractional horsepower motors which may have sleeve bearings

- E Connection Boxes On fractional horsepower motors, where the connections are made in the end bell space rather than in an attached connection box a screwed conduit connection shall be provided in the end bell Where sheet metal terminal boxes are provided, they shall include knockouts for conduit terminations
- F Refer to Section 16050 Part I for additional requirements
- G Motor information required of equipment manufacturer
 - 1 Manufacturer
 - 2 Voltage rating
 - 3 Horsepower
 - 4 Full load speed revolutions per minute,
 - 5 Full load current
 - 6 Frame number
 - 7 Enclosure
 - 8 Mounting (horizontal or vertical)
 - 9 Base (flange or foot)
 - 10 Slide rails (V belt driven)
 - 11 Temperature rise C
 - 12 Insulation class,
 - 13 Rotation (viewed from shaft end)
 - 14 Duty cycle
 - 15 Location of terminal box and
 - 16 Special modifications

1 2 MOTOR CONTROL

- A Single Phase Manual Starters Single phase manual starters shall consist of a toggle switch single or double pole with a thermal overload heater element capable of interrupting the circuit incase of overload These manual motor starters shall be furnished with a NEMA Type 1 enclosure unless otherwise specified

- B Magnetic Motor Starters Magnetic motor starters shall be installed in all cases where remote control is required and no voltage or undervoltage protection is required. Three overload relays for installation of interchangeable overload relay heaters shall be furnished with each starter. Operating coil voltage, enclosure, number and position of auxiliary contacts, NEMA size and all starter modifications shall be as shown on the drawings.

1 3 REMOTE CONTROL UNITS

- A Pushbuttons, automatic selector switches and pilot lights shall be of the Allen Bradley Bulletin 800T oil tight type.
- B Limit switches, unless otherwise specified, shall be Allen Bradley Bulletin 802T oil tight units.

PART II PRODUCTS

2 1 MOTORS Reference this section Part I

2 2 MOTOR CONTROL

- A Single Phase Manual Starters Single phase manual starters shall conform to Allen Bradley Bulletin 600.
- B Magnetic Motor Starters Starters shall conform to the following:
 - 1 Full Voltage Starters Allen Bradley Bulletin 709
 - 2 Combination circuit Breaker and starter Allen Bradley Bulletin 713

2 3 REMOTE CONTROL UNITS

- A Refer to Allen Bradley Bulletin 800T for oil tight type pushbuttons, selector switches and pilot lights.
- B Refer to Allen Bradley Bulletin 800T for oil tight type limit switches unless otherwise specified.

PART III EXECUTION

Refer to Part III of Section 16050 for applicable requirements.

END OF SECTION 16150

SECTION 16450

GROUNDING

PART I GENERAL

1 1 WORK INCLUDED

- A Work under this section includes providing grounding systems as shown on the Drawings and as specified herein
- B Furnish all labor materials tools and equipment and perform all work and services necessary for or incidental to the erection and installation of the equipment in this section complete with accessories as shown on the contract Drawings and as specified herein in accordance with the provisions of the Contract Documents and completely coordinated with that of all other trades
- C Although such work is not specifically shown or specified, all supplementary or miscellaneous items appurtenances and devices incidental to or necessary for a sound secure and complete installation of equipment in this section shall be provided as part of this work

1 2 QUALITY ASSURANCE REFERENCED SPECIFICATIONS AND DOCUMENTS

Comply with the provisions of the following defined codes standards and specifications except as otherwise noted or specified Where a conflict occurs the more stringent requirement shall govern The publications listed below are referred to in the text by the basic designation only

- 1 National Electrical Code (NEC) latest edition
- 2 Institute of Electrical and Electronic Engineers (IEEE) Standard 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems
- 3 All electrical materials shall be new and as listed by the Underwriters' Laboratories Inc (UL) except as otherwise specified herein

PART II PRODUCTS

2 1 GROUNDING ELECTRODES

- A Grounding electrodes shall consist of 3/4 in or larger galvanized steel pipe or 5/8 in or larger galvanized or copper clad steel rods
- B The preferred electrode shall be the copper clad steel rod 10 ft long

- C The standard length electrode shall be 10 ft Where electrodes are longer than the standard, their length shall be clearly marked near the top
- D The size of the electrode used will depend on its length and the driving quality of the soil It shall if possible be long enough to reach permanently moist earth below the frostline

2 2 CONDUCTORS

- A Equipment Grounding Conductor The equipment grounding conductor shall be an insulated (green) copper conductor
- B Grounding Electrode Conductor The grounding electrode conductor shall be copper

PART III. EXECUTION

3 1 PIPE AND ROD ELECTRODES

- A Electrodes shall be driven at a distance of not less than 3 ft from the building foundation walls or structure footings
- B Where convenient and with the approval of the Buyer they may be driven in the bottom of excavations
- C Isolated ground electrodes shall be left with their tops projecting 6 in above the grade so that the removable connectors are accessible for inspection and testing of ground resistance

3 2 GROUND CONNECTIONS

- A All ground connections shall be bolted or brazed
- B In order to ensure a low resistance joint, care shall be taken in cleaning and preparing the contact surfaces
- C Connections of ground leads to isolated electrodes shall be made with bolted clamp type connectors to facilitate removal for testing
- D No ground connections shall be made to gas piping

3 3 EQUIPMENT GROUND SYSTEM

- A All metallic raceways electrical equipment and related enclosures shall be continuously grounded

- B A separate equipment grounding conductor (green wire) shall be installed in all raceways for feeders branch circuits etc regardless of size location or length

3 4 TESTING GROUNDS

- A All grounds shall be tested and recorded in accordance with the specifications by a double scale (0 30 and 0 300 Ohms) Megger ground tester Type MEG, as manufactured by James G Biddle Company
- B Records of each inspection and test together with complete data and readings associated therewith, shall be entered on a form furnished by the Buyer for this purpose Test data taken and compiled during the inspections shall be certified by the Contractor and with the Buyer witnessing the tests Records of the inspections and tests together with the complete data on all readings taken shall be made and incorporated into a formal report
- C The lowest possible resistance to ground is desirable It shall not exceed 5 Ohms

END OF SECTION

SECTION 16700

HEAT TRACING

PART I. GENERAL

Refer to Section 16010 Part I for general requirements

1 1 HEAT TRACING REQUIREMENTS

- A The Contractor shall provide all heat tracing cable all accessories and completely install the entire heat tracing system so that it will provide complete freeze protection for all pipelines (including valves flanges etc) described below and as shown on project drawings
- B Pipelines Heat Traced
 - 1 All pipelines run exposed outdoors shall be heat traced
 - 2 Vertical legs of buried pipelines shall be heat traced to approximately 5 0 below grade
- C Fluid in pipelines is basically water with limited quantity of contaminants
- D Approximate minimum water temperature desired is 50 degrees Fahrenheit
- E Minimum expected ambient temperature is minus 30 degrees Fahrenheit
- F All pipelines which are to be heat traced are made of either CPVC or polypropylene and are insulated as described in the appropriate specification sections of this Contract
- G The heat tracing system includes heat tracing cable insulation sleeves, molded boots, insulation retainers, splice boxes, end seals, cable ties fittings supports hardware thermostats and any other required components All equipment shall be Chemelex Auto Trace as indicated, specified and required
- H Heat tracing cable shall be self limiting type which automatically limits its own maximum temperature Below maximum temperature the heater shall regulate its own heat output The built in temperature control shall be accomplished by a semi conductive heating material whose electrical resistance varies with its temperature
- I Heat tracing cable shall have two (2) No 16 AWG copper bus wires a self regulating semi conductive core modified

polyolefin jacket, and a fluoropolymer outer jacket covering a tinned copper shield Heat tracing cable shall be Chemelex Auto-Trace Type 5BTV1 CT with an output of 5.9 Watts per foot at 50 degrees Fahrenheit or an equivalent member of the BTV1 CT family with required heat output for the application

- J Each heat tracing circuit shall operate at 120 V AC and 60 Hz Control of all circuits shall be by an ambient sensing thermostat controller Chemelex Type AMC 1A (BD) The thermostat controller shall activate a contactor in Panel P to allow energization of the heat tracing circuits The thermostat controller shall become energized at a temperature of 40 degrees Fahrenheit

K

- 1 Each two (2) inch diameter pipeline shall be heat traced with at least one 5BTV1 CT cable attached to the pipe per standard Chemelex installation details
- 2 Each four (4) inch diameter pipeline shall be heat traced with at least two 5BTV1 CT cables attached to the pipe per standard Chemelex installation details
- 3 Flanges valves and supports shall be provided with the proper configuration of one or two 5BTV1 CT cables to maintain the 50 degrees Fahrenheit pipe fluid temperature Heat tracing cable installation for flanges valves supports etc shall be per standard Chemelex installation details

- L Isometric Drawings and Details Contractor shall furnish isometric drawings of the complete heat traced pipeline installation for this project The drawings shall show clearly each heat traced pipe the heater cable or cables used for each pipe, the designation of the circuit breaker supplying each heat tracing cable circuit references to specific heater cable installation details for each pipeline valve flange and support and all junction boxes required to interface between heat tracing cable and power circuit cable

Contractor's detailed design of the heat tracing system shall utilize a maximum of ten 20 Amp 120 VAC circuits to supply all heat tracing cable installed for the project pipelines

Installation by the Contractor of heat tracing cable shall be based on approved isometric drawings

- M Labels reading ELECTRIC TRACED shall be installed on the outside insulation of all electrically heat traced piping

The labels shall be placed at an interval of 20 feet or less so that they are readily visible

N Submittals

- 1 Submit for engineer's review all isometric drawings and details furnished for heat tracing system installation
- 2 All calculations made for sizing required heat tracing cable for each pipeline run shall be provided for engineer's review

PART II. PRODUCTS

2 1 MANUFACTURERS

Heat tracing equipment shall be Chemelex Auto Tracer

PART III. EXECUTION

Refer to Section 16010 Part III, for applicable requirements

END OF SECTION 16700

SECTION 17000

GENERAL INSTRUMENTATION CONTROL AND MONITORING REQUIREMENTS

PART I GENERAL

1 1 DESCRIPTION

ICM Specifications Section 17000 through 17999 are hereinafter called the ICM Sections. This Section covers the general requirements for furnishing and installation of all instrumentation control and monitoring (ICM) systems complete in every detail for the purposes specified and shall form a part of all ICM Sections of Division 17 unless otherwise specified. Other ICM Sections shall supplement this Section as necessary.

A Work Included in the ICM Section of Division 17 Instrumentation work as indicated specified and required. The intent of the ICM Sections of Division 17 is to require that the complete Instrumentation Control and monitoring System i.e. primary elements panel mounted and miscellaneous field instruments etc shall be furnished by a single ICM Subcontractor to assure system uniformity subsystem compatibility and coordination of all system interfaces. Deviations may be considered in special circumstances but must be approved by the Buyer.

- 1 Furnish all tools equipment materials and supplies and perform all labor required to complete the furnishing and installation of including all instrumentation signal and power conduit and wiring not specifically shown on the electrical drawings validation start up and operational testing of a complete and operable Instrumentation Control and Monitoring System as indicated on the Drawings and as specified herein.
- 2 Provide all the necessary equipment components and interconnections and the services of the manufacturers engineering representatives for the engineering implementation start up operation and instruction to insure that the Buyer receives a completely integrated and operational ICM as herein specified.

B Related Work Specified Elsewhere

- 1 Process piping installation of in line instrumentation i.e. primary and final control elements in process pipelines and miscellaneous mechanical work as specified elsewhere in this Specification.

- 2 Electrical power distribution specifically included under Division 16 circuit protection devices, instrumentation signal and power conduit and wiring indicated, and miscellaneous electrical requirements as specified in Division 16

1 2 SYSTEM RESPONSIBILITY

Contractor's attention is directed to the fact that the ICM system as specified in these ICM Sections of Division 17 is an integrated system and therefore shall be provided by a single competent qualified instrumentation Subcontractor (hereinafter referred to in these ICM Sections as the ICM Subcontractor) who shall have total responsibility for the work of this Division. Entire system installation including calibration, validation, start up, operational testing, and training shall be performed by qualified personnel possessing all the necessary equipment and who have had experience performing similar installations. The System shall be integrated using the Subcontractor's latest most modern proven design and shall as far as practical be of one manufacturer. Overall system performance shall be guaranteed by the specified ICM Subcontractor.

- A The Contractor shall subcontract the work under these ICM Sections to a qualified ICM Subcontractor who shall perform said work but it shall be understood that this shall not relieve the Contractor from any responsibility under the Contract. Although many references made herein are to work requirements and responsibilities of the ICM Subcontractor such references shall only mean that responsibility shall pass through the ICM Subcontractor but in the final analysis shall rest with the Contractor.
- B The ICM Subcontractor shall be responsible for the correct installation of all hardware and systems specified in these ICM Sections. Certain Primary elements Final Control Elements etc although provided as part of this Division shall be installed in the process lines under other Divisions of these Specifications, however, this installation shall be under the direct supervision of the ICM Subcontractor.
- C The ICM Subcontractor shall be responsible to see that all components of the instrumentation system, including primary measuring indicating transmitting receiving recording totalizing controlling and alarming devices and all appurtenances are completely compatible and shall function as outlined and he shall furnish and install such additional equipment accessories etc as are necessary to meet these objectives at no cost to the Buyer.

1 3 QUALITY ASSURANCE

- A Qualification And Manufacturers The ICM subcontractor shall be a recognized PLC systems integrator a panel fabricator and installer of field instruments The ICM subcontractor's place of business shall be within a 200 mile radius of the jobsite and the ICM subcontractor shall have been in business at that location for a minimum of five years The ICM Subcontractor shall have a minimum of 10 years documented experience in providing ICM equipment on a single system responsibility basis for municipal water and wastewater treatment processes Also the personnel employed for system engineering supervision start up operational testing and training shall be regular employees of the ICM Subcontractor The ICM Subcontractor shall be fully responsible for the technical supervision of the installation to ensure that it is proper in all respects
- B Certification By Single ICM Subcontractor At the time of quoting to prospective Contractor prior to bid opening, each prospective single ICM Subcontractor shall execute and submit a written certification of intent to assume full responsibility for the complete requirements of all ICM Sections

Each prospective Contractor shall include with his proposal the certification required above for the proposed single ICM Subcontractor Each certification shall be as included in the proposal form it shall be signed by his authorized responsible representative and it shall include the following statement

_____(Corporate name of Subcontractor)_____
hereby certifies intent to assume and execute full responsibility to select to furnish to supervise installation and connection to test calibrate, validate and place into operation all meters instruments alarm equipment control panels and all other assemblies components, and accessories needed to place into service complete operating process control systems all in full compliance with the requirements of all ICM Sections

In addition it is certified that drawings and data will be prepared and submitted specified field services will be performed by qualified personnel operating personnel will be instructed and technical manuals will be prepared and submitted and as required by the ICM Sections

Finally it is certified that the quotation offered provides for full and complete compliance with the requirements of the ICM Sections of Division 13 without exception

- C **Standard of Quality** Furnish equipment of the types and sized specified which has been demonstrated to operate successfully. Wherever on the Drawings and in these Specifications, materials or equipment have been specified by using the name of products or manufacturers the term or approved equal is always understood to follow immediately. Material or equipment so specified have been selected as being most suitable and are regarded as a standard and are not intended to eliminate others of equal quality and performance. The order of listed manufacturers shall not be construed as a preference or order of quality. Workmanship for the installation of instruments wiring piping painting and labeling shall be equal to the best industrial standards for instrumentation and control work.

All electrical equipment and materials, including their installation, shall conform to Division 16 unless specified otherwise in this Division.

- D **Factory Inspection** Buyer or his representative may inspect fabricated equipment at the factory. Notify Buyer in sufficient time so that factory inspection can be arranged. Factory inspection shall be made only after manufacturer has performed satisfactory checks adjustments tests and operations. Tests shall be made using simulated inputs and output loads. Approval of equipment at the factory only allows the manufacturer to ship the equipment to the site and does not constitute final acceptance by Buyer.

The Buyer will indicate on return of the approved submittal each item requiring factory inspection. Lack of such indication by the Buyer shall constitute a waiver of factory inspection.

1 4 **DRAWINGS**

- A **Information on the Drawings** The following information relative to the work of the ICM Sections is indicated on the Drawings:
- 1 Location of all primary elements control panels and final control elements
 - 2 Instrumentation signal and power conduit runs between control panels and field instruments and devices
 - 3 Quantity and sizes of instrumentation conductors and cables are indicated on the drawings but shall be verified by the ICM Subcontractor
 - 4 Location of all equipment having alarm and equipment status contacts

5 Major instrument conduit runs

6 General control room and control panel layouts

B Information Not Shown On The Drawings The following information relative to the work of the ICM Sections may not be shown on the Drawings but shall be the responsibility of the ICM Subcontractor to determine, furnish, coordinate with other Divisions and submit for approval, based upon the systems specified

1 Tubing for hydraulic and pneumatic signals and/or power between main headers and control panels, field mounted primary elements field instruments and final control elements

2 Number or sizes of tubing required for all pneumatic, and hydraulic signals

3 Point of connection to any hydraulic or pneumatic supply lines

4 Detailed control panel layouts

1 5 SUBMITTALS

Refer to Division 1 for required method of preparation and transmittal and conform to requirements herein

A Presubmittal Conference Arrange a conference between the ICM Subcontractor and the Buyer or his representative within sixty (60) days after award of the Contract for the purpose of informally discussing in detail and verifying the correctness of the ICM Subcontractor's system engineering methods and equipment and to generally provide a framework for communication and coordination This conference shall be attended by ICM Subcontractor's Engineer and duly authorized representatives of the Contractor and Buyer

Prepare a draft of the submittal for review The draft shall include the following as a minimum

Listing of major items proposed for this Division Identify items by tag number description function manufacturer model number descriptive literature and statement as to whether item is as specified or equivalent Items identified as equivalent shall be accompanied by a comparative listing of the published specifications for the item specified and for the item proposed

- B Shop Drawings Before proceeding with any manufacturing submit Shop Drawings for approval in complete bound sets indexed by specification number Describe the items being submitted Manufacturer's specification or data sheets shall be clearly marked to delineate the options or styles to be furnished Submit only complete systems not pieces of equipment from various systems Show dimensions, physical configurations methods of connecting instruments together mounting details and wiring schematics Schematics shall be complete with tag and terminal numbers Submit fabrication drawings nameplate legends and control panel internal wiring and piping schematic drawings clearly showing all equipment and tag numbers on all panels Submit panel graphic drawings where applicable Include material specifications lists where applicable include a draft of the theory of operation for all relay logic circuits including those implemented via programmable controllers to be included in the instruction manual required below

Submit an Equipment Specification Data form for each item equipment which shall summarize the specification features as called for in these Specifications and include other necessary data as would provide a complete and adequate specification for reordering an exact duplicate of the original item from the manufacturer at some future date The assigned tag numbers and manufacturer's part numbers shall be included but will not be considered as a substitute for any of the required statement of specifications More than one tag numbered item may be included on a sheet

- C Loop Diagrams Prepare and submit instrumentation loop diagrams for all work included in the ICM Sections in accordance with Instrument Society of America Standard 15A S5 4
- D Record Drawings Contractor shall submit reproducibles of complete schematics wiring diagrams and installation drawings to include all installed field and panel conduit and piping/tubing runs and routing tray systems supports mounting details point to point diagrams with a cable wire tube and termination numbers Drawings shall be a record of work as actually constructed and shall be labeled as Record One copy of applicable schematics and diagrams shall be placed in each control panel in a protective envelope or binder
- E Instruction Manuals Furnish six (6) sets of Instruction Manuals and Pat Lists for instrumentation equipment provided under the ICM Sections Obtain distribution method instructions from Buyer or his representative

- 1 Schedule Deliver two (2) copies of manuals not later than the equipment shipment date After installation is complete update the manuals to reflect any changes which occurred during installation and deliver balance of manuals to Buyer
- 2 Contents Include in the manuals not less than the following information as applicable for each instrument equipment subsystem and/or control loop
 - a General introduction and overall description purpose, functions simplified theory of operations etc
 - b Specifications (including equipment specification data sheet as described above under Shop Drawings)
 - c Installation instructions procedures, sequences, tolerances and precautions
 - d Operational procedures
 - e Shut down procedures
 - f Maintenance calibration and troubleshooting instructions
 - g Schematics and wiring diagrams
 - h Detailed circuit operational description including annotated programmable controller ladder diagrams
 - i Parts list and spare parts recommendations
- 3 Format Use drawings and pictorials to illustrate the text to the extent necessary to ensure a clear, concise presentation If manuals have been written to cover a family of similar instruments or equipments, strike out inapplicable information in a neat fashion or emphasize applicable portion by heavily weighted arrows circles or boxes whichever provides the clearest and neatest presentation Where identical instruments are used in more than one control loop or subsystem include only one instruction manual however an index by tag number for all instruments shall identify its location in that manual

Control loop and/or subsystem operational descriptions shall identify the function of each instrument and its relation to the other instruments in the loop

4 Binding Bind each manual in a cover which indicates the system name manufacturer's name, local address and telephone number and year of purchase Punch and bind manuals in standard three ring binders and include system name and ICM Subcontractor's name on binding

F ICM Subcontractor's Certified Reports The ICM Subcontractor or his authorized representative shall submit a certified report for each control panel and associated field instruments certifying that the equipment (1) had been properly installed under his supervision (2) is in accurate calibration, (3) was placed in operation in his presence (4) has been checked inspected calibrated and adjusted as necessary (5) has been operated under maximum power variation conditions and operated satisfactorily and (6) is fully covered under the terms of the guarantee

G Demonstration And Final Operating Test Plans And Results Submit for approval not later than 30 days prior to the test demonstration, a written plan for demonstrating that each system of equipment provided under the ICM Sections meets the specified operational requirements The plan shall include procedures to be used in final operation testing of entire systems including a description for each system of test methods and materials testing instruments and recorders a list of the equipment involved with the functional parameters to be recorded on each item and shop drawings of required temporary by passes and like facilities Submit three copies of test results and records for all final operation tests

1 6 PRODUCT DELIVERY STORAGE AND HANDLING

Box crate, or otherwise enclose and protect instruments and equipment during shipment handling and storage Keep all equipment dry and covered from exposure to weather moisture corrosive liquids and gases or any element which could degrade the equipment Protect painted surfaces against impact abrasion discoloration and other damage Repair any damage as directed and approved

1 7 JOB CONDITIONS

Drawings are diagrammatic and show the intended arrangement for system operation piping and appurtenances Conform to Drawings as closely as possible and exercise care (1) to secure neat arrangement of piping valves conduit and like items and (2) to overcome structural interferences Verify dimensions and conditions at the place of work and install materials and equipment in the available spaces

1 8 GUARANTEE AND WARRANTIES

Guarantee all work of the ICM Sections in accordance with the Conditions of Contract and Division 1 With respect to instruments and equipments guarantee shall cover (a) faulty or inadequate design (b) improper assembly or erection (c) defective workmanship or materials and (d) leakage breakage or other failure not caused by Buyer misuse For equipment bearing a manufacturer's warranty in excess of one year, furnish a copy of the warranty to Buyer with Buyer named as beneficiary

1 9 ACCESSORY AND MAINTENANCE MATERIALS

Furnish the following items as specified herein Deliver to Buyer, as directed with itemized list in a letter of transmittal accompanying each shipment

- A Special Tools And Accessories Furnish special tools, instruments and accessories for maintaining instruments and equipment requiring periodic repair and adjustment as specified elsewhere herein Also furnish special lifting and handling devices for equipment requiring such devices
- B Maintenance Materials And Spare Parts Deliver in manufacturer's original containers labeled to completely describe contents and equipment for which it is furnished

Spare parts shall consist of the following basic items

- 1 Five (5) percent but not less than one (1) minimum of each type of plug in unit etched or printed circuit board assembly
- 2 Ten (10) percent but not less than one (1) of each type recorder chart drive mechanism installed
- 3 Ten (10) percent but not less than one (1) of each type relay and timer used
- 4 Ten (10) percent but not less than one (1) of each type switch used
- 5 Ten (10) percent but not less than six (6) of each type light bulb and fuse used
- 6 Minimum of one (10) year supply of expendable items such as charts ink ribbons etc

PART II PRODUCTS

2 1 MATERIALS AND STANDARD SPECIFICATIONS

Provide instruments equipment and materials suitable for service conditions and meeting standard specifications such as ANSI, ASTM, ISA and SAMA. The intent of this Specification is to secure instruments and equipment of a uniform quality and manufacture throughout the plant i.e. all instruments in the plant supplied by the ICM Subcontractor of the same type shall be by the same manufacturer. This allows the stocking of the minimum number of spare parts.

2 2 STRUCTURAL STEEL FABRICATIONS

Design all fabrications for dynamic and vibratory loadings. Use structural steel shapes conforming to ASTM A36, A500, A501, A570, A618 or equal, as applicable. Conform welding to AWS D2.0 Code. Galvanize specific items in accordance with ASTM A123 or A386 as applicable. Use galvanized bolts and fasteners with galvanized assemblies. Use minimum 1/4" thickness for steel entirely or partially submerged during equipment operation. Submit design calculations showing adequate structural integrity for the intended purpose.

2 3 MOUNTINGS

Mount and install equipment as indicated. Where not shown, mount field instruments according to best standard practice on pipe, mounts, pedestal mounts or other similar means in accordance with supplier's recommendation. Where mounted in control panels, mount according to requirements of that Section.

Equipment specified for field mounting shall be suitable for direct pipe mounting, pedestal mounting or surface mounting and non-in-line indicators and equipment with calibration adjustments or requiring periodic inspection shall be mounted not lower than three (3) feet nor higher than five (5) feet above walkways, platforms, catwalks, etc. All such equipment shall be weather and splash proof, and electrical equipment shall be in NEMA 4 cases. If mounted in a designated hazardous area, the equipment shall be explosion proof or rated intrinsically safe, whether so specified herein or not.

2 4 INSTRUMENT IDENTIFICATION

All major instrumentation and equipment items or systems specified in the ICM Sections are identified by system and tag numbers. This same number appears in the tag number designations on the Drawings and on the schedules of these Specifications. All instrumentation and equipment shall be identified by nameplates and/or tags. Nameplates for panels and panel mounted equipment shall be as

specified under Panels and Control Room Hardware Field equipment shall be tagged with assigned instrumentation tag number and function Tags shall be black lamacoid with engraved white characters of 3/16 inch minimum height Tags shall be attached to equipment with a commercial tag holder using a stainless steel band with a worm screw clamping device or by a holder fabricated with standard hose clamps and meeting the same description In some cases where this would be impractical use 20 gauge stainless steel wire For field panels or large equipment cases use stainless steel screws, however such permanent attachment shall not be on an ordinarily replaceable part In all cases the tag shall be plainly visible to a standing observer In addition to tags field mounted control stations recorders or indicators shall have a nameplate indicating their function and the variable controlled or displayed Nameplate shall be attached by one of the above methods

2 5 ELECTRONIC EQUIPMENT

If the equipment is electronic in nature provide solid state equipment to the extent practicable Select components of construction for their suitability and reliability Employ adequate component derating to preclude failures because of transients and momentary overloads reasonably expected in normal operation Design units for operation without forced cooling unless such cooling is an integral part of the device

2 6 EQUIPMENT OPERATING CONDITIONS

All equipment shall be rated for normal operating performance with varying operating conditions over the following minimum range

A Power

- 1 Electrical 120 Vac \pm 10%, 60 Hz \pm 1 Hz except where specifically stated otherwise on the drawings or in the specifications
- 2 Air 20 psig \pm 1 psig

B Field Instruments

- 1 Outdoor Areas
Ambient Temperature 15 F to 120 F
Ambient Relative Humidity 5% to 100%
Weather Rain sleet snow ice wind sun and blowing sand
Provide as necessary enclosures sunshields thermostatically controlled heaters etc to assure normal operations under these conditions

- 2 Indoor Unheated Areas
Ambient Temperature 5 F to 120 F
Ambient Relative Humidity 5% to 100%
- 3 Indoor Environmentally Controlled Areas
Ambient Temperature 50 F to 95 F
Ambient Relative Humidity 5% to 100%

2 7 POWER SUPPLIES

Provide electrical instruments and control devices for operation on 120 Vac 60 Hz current. This requirement is to prevent total loss of control because of the failure of a common DC power supply. This requirement will be waived upon demonstration to the satisfaction of the Buyer that the ICM Subcontractor shall install dual DC power supplies in each panel with automatic failure detection and annunciation and witch over without loss of control functions. These dual power supplies shall be totally independent with all solid state rectifiers regulators failure sensing (with front of panel indication) and output switching. Source of operating power shall be 120 Vac 60 Hz commercial power. Units shall be rack mounted within the control panels.

2 8 SIGNAL ISOLATORS CONVERTERS AND CONDITIONERS

Insure that input output signals of all instruments and control devices (whether furnished by the ICM Subcontractor or not) are compatible. Unless otherwise specified signals between field and panels shall be 4 to 20 mAdc unless specifically approved otherwise. Granting such approval does not relieve the ICM Subcontractor from the compatibility requirement above. Provide signal isolators and converters as necessary to obtain the required system performance. Mount the devices behind control panels or in the field at point of application. provide items as manufactured by ACM Electronics Moore Industries or Rochester Instrument Systems.

2 9 AUXILIARY CONTACTS BY OTHERS

Provide instruments and equipment to connect to auxiliary contacts provided by others for alarms status of equipment, interlocking and other functions as indicated and as specified herein.

2 10 AIR SUPPLY VALVES

Provide valves for instrument air supply shutoff, regulating switching metering valve manifolds, etc equal to valves manufactured by Whitey Company Nupro Company Hoke Inc or equal.

2 11 INSTRUMENT PIPING

Provide instrument air and instrument pneumatic piping as specified in other Divisions and as necessary and/or as specified herein. Instrument air header shall be furnished and installed under other Divisions. Connect to main instrument air header at a point not more than ten (10) feet distant from air consuming device(s). Use 1/2 inch minimum 316 stainless steel tubing. All connections to equipment shall be made with separable or union type fittings and shall include shut off valves. All hydraulic and/or pneumatic piping shall be tested for leaks prior to placing the system in operation. Provide instrument pneumatic air fittings, with double ferrule, which shall be Swagelok manufactured by Crawford Fitting Company, Cajon manufactured by Cajon Company Gyrolok by Hoke Inc.

2 12 FILTER REGULATOR

Furnish a filter regulator and discharge Pressure gauge furnished with a dripwell assembly for each point of use where regulated instrument air is required. Separate regulators shall be used for each control loop. Regulators shall be Fisher 67FR, or Musoneilan 80 4.

2 13 MANIFOLDS

Furnish an integral three valve manifold for each differential pressure transmitter on a flow application. Manifolds shall be equal to Anderson Greenwood M 4A Hoke or Swagelok.

2 14 PAINTING

Provide factory paint for all instruments and equipment except where in pipelines. Provide paint as required in Division 9 for structural supports brackets etc.

2 15 ELECTRICAL

- A The construction work shall include all the power supply wiring, instrumentation wiring interconnecting wiring and equipment grounding as indicated, specified and required and not specifically included under Division 16.
- B Wiring installations shall include cables, conductors, terminals connectors wire markers conduits conduit fittings supports hardware and all other required materials not specifically included in the work of other Divisions.
- C Provide the materials and complete all the required installations for equipment grounding as specified in Division 16 of these Specifications, and indicated on the Electrical Drawings.

- D Incidental items not specifically included in the Contract Documents that can legitimately and reasonably be inferred to belong in the instrumentation work shall be provided by the ICM Subcontractor
- E Field Wiring For wiring materials refer to Division 16 and Details on the Electrical Drawings Ring out signal wiring prior to termination Provide wire number tags marked in indelible waterproof form of slip on type or equal for each termination Provide pre insulated crimp on connectors for wire terminations and splices Use ratchet type crimping tool which does not release until proper crimp pressure has been applied
- F A minimum specification of 9 is required between signal wires and power wiring

2 16 PROCESS CONNECTIONS

Piping tubing and capillary tubing shall be 316 stainless steel If this material is unsuitable for ambient or process conditions piping and tubing shall be of a material approved by Buyer Slope lines according to service to promote self draining or venting back to the process Terminate connection to process lines or vessels in a service rated block valve that will permit closing off the sense line or removal of the element without requiring shut down of the process Include drip legs and blow down valves for terminations of sense lines at the instruments when connecting fittings an block valves shall be furnished and installed under other Divisions of these Specifications but coordinated by the ICM Sections Instrument process taps shall be a minimum 3/4 inch NPT except flowmeter taps which shall be 1/2 inch NPT Provide Anderson Greenwood gauge valves part number M5VHS 46 with a part number H7VS 44a bleed valve for 3/4 inch taps For 1/2 inch flowmeter taps the gauge valves shall be part number M5VHS 44 with a H7VS 44Q bleed valve

PART III EXECUTION

3 1 INSPECTION

Inspect each instrument and piece of equipment for damage defects completeness and correct operation before installing Inspect previously installed related work and verify that it is ready for installation of instruments and equipment

3 2 PREPARATION

Ensure that installation areas are clean and that concrete or masonry operations are completed prior to installing instruments

and equipment Maintain the areas in a broom clean condition during installation operations

3 3 FACTORY TESTING OF CONTROL PANELS

Verify at the factory, wiring continuity and verify panel operation by simulated inputs and outputs Provide report certifying the control panels are operable and meet the Specifications

3 4 MANUFACTURERS INSTALLATION AND SUPERVISION

When specified in Sections 17100 17200 and 17300 furnish the services of authorized factory personnel especially trained and experienced in the installation of the equipment to (1) supervise the installation in accordance with the approved Instruction Manual (2) be present when the instruments and equipment are first put into operation (3) inspect check adjust as necessary and approve the installation (4) calibrate the instruments in accordance with the Specifications herein until all trouble or defects are corrected and the installation and operation are acceptable and (5) prepare and submit the specified Manufacturers Certified Report Include all costs for representative s services in the Contract Price

3 5 INSTRUMENT CALIBRATION

Provide the services of trained and experienced instrumentation technicians tools and equipment to field calibrate each instrument to its specified accuracy in accordance with the manufacturer s specifications and instructions for Calibration Each instrument shall be calibrated at 10 percent 50 percent and 90 percent of span using test instruments to simulate inputs and read outputs that are rated to an accuracy of at least 5 times greater than the specified accuracy of the instrument being calibrated Such test instruments shall have accuracies traceable to the National Bureau of Standards as applicable provide a list and basic specifications for instruments used Provide a written report to the Buyer on each instrument certifying that is has been calibrated to its published specified accuracy This report shall include all applicable data as listed below plus any defects noted corrective action required, and correction made Data shall be recorded on prepared forms and shall include not less than the following items

- (1) Facility identification (Name location etc)
- (2) Loop identification (Name or function)
- (3) Equipment tag and serial numbers
- (4) Scale Ranges and units
- (5) Test mode or type of test
- (6) Input values or settings
- (7) Expected outputs and tolerances
- (8) Actual readings

- (9) Explanations or special notes as applicable
- (10) Tester's certification with name and signature

3 6 SYSTEM VALIDATION

Provide the service of trained and field experienced instrumentation engineer(s) to validate each system to verify that each system is operational and performing its intended function within system tolerance. System tolerance is defined as the root mean-square sum of the system component published specified accuracies from input to output. Validate each system by simulating inputs at the first element in loop (i.e. sensor) of 10 percent, 50 percent, and 90 percent of span or on/off and verifying loop output devices (i.e. recorder, indicator, alarm, etc. except controllers). During system validation, make provisional settings on levels, alarms, etc. Verify controllers by observing that the final control element moves in the proper direction to correct the process variable as compared to the set point. Verify that all logic sequences operate in accordance with the specifications.

Cause malfunctions to sound alarms or switch to standby to check system operation. Check all systems thoroughly for correct operation. Test equipment for this function shall be as specified under Instrument Calibration.

Immediately correct all defects and malfunctions disclosed by tests. Use new parts and materials as required and approved and retest. Provide a report certifying completion of validation of each instrument system. This report shall indicate calculated system tolerances, data verifying that the system meets these tolerances, and any provisional settings made to devices. Data sheets shall be similar to those used for Calibration.

3 7 FINAL OPERATIONAL TESTING AND ACCEPTANCE

Upon completion of instrument calibration and system validation, test all systems under process conditions. The intent of this test is to demonstrate and verify the operational interrelationship of the instrumentation systems. This testing shall include, but not be limited to, all specified operational modes taking process variables to their limits (simulated or process) to verify all alarms, failure interlocks, and operational interlocks between systems and/or mechanical equipment.

Immediately correct defects and malfunctions with approved methods and materials in each case and repeat the testing. Upon completion of final operational testing, submit certified report with substantiating data sheets indicating that total ICM System meets all the functional requirements specified herein. The Buyer will countersign this report and it shall constitute final acceptance of the ICM System.

Testing shall be observed by the Buyer. Notify the Buyer in writing a minimum of 48 hours prior to the proposed date for commencing the test. Upon completion of this test the Contractor shall begin or have begun system start up. Buyer reserves the right to set the schedule.

3.8 START UP ASSISTANCE

When specified in Section 17100, 17200 and 17300 provide the services of a factory trained and field experienced instrumentation engineer to assist Buyer's personnel during startup of the system. Purpose of this assistance is to support in making final adjustments of settings on the instrument systems.

3.9 INSTRUCTION OF BUYER'S PERSONNEL

Provide the services of a trained and field experienced instrumentation engineer to conduct group training of Buyer's designated personnel in the operation of each instrument system. This training shall be for a minimum time period of 3 days, one day of which may be performed during the operational testing period. Obtain Buyer's written consent that the training has been adequate. Include instruction covering basic system theory, operating principles and adjustments, routine maintenance and repair, and hands on operation. The text for this training shall be the single line loop system drawings, P&IDs, I Drawings, and operation and maintenance manuals furnished under these Specifications.

END OF SECTION 17000

SECTION 17050

INSTRUMENTATION, CONTROL AND MONITORING SYSTEM DESCRIPTION

PART I GENERAL REQUIREMENTS

- 1 1 DESCRIPTION This Section describes the Instrumentation, Control and Monitoring (ICM) System for the 881 Hillside treatment facility. It is the intent of this Section to also supplement where applicable other Sections of Division 17. Certain systems described are supplied as package systems or Government Furnished Equipment (GFE) discussed under other Sections by the Buyer, and are so identified. This Section briefly describes each system in order that the ICM subcontractor, as well as the suppliers of GFE and other package systems, shall be aware of the magnitude of the total ICM system.

The equipment to be furnished in this Phase IIB package includes instrumentation and controls for the two collection gallery sumps, collection well and influent pipeline leak detection system. All other instrumentation and controls for 881 Hillside Remedial Action have been provided in other phases of construction for the project. A complete system description for instrumentation and control of 881 Hillside Remedial Action is provided here for reference.

The 881 Hillside treatment facility consists of a series of remote ground water collection and transmission systems and a central treatment facility located in Building 891. The collection facilities include a collection well and three sumps located at low points in a french drain. Submersible pumps are used to transfer the collected ground water to 15,000 gallon influent storage tanks D 201 or D 202. The tank to be filled shall be manually selected by the operator through a valve line up.

Water from D 201 or D 202 is fed to an ultraviolet (UV)/hydrogen peroxide (peroxide) treatment unit (provided as GFE by the Buyer) by transfer pumps P 301 and P 302. Flow from the UV/peroxide system is collected in 15,000 gallon ion exchange storage tank D 203 and processed through an ion exchange treatment unit (provided as GFE by the Buyer). Flow from the ion exchange unit is directed to 110,000 gallon effluent storage tanks D 205, D 206 or D 207.

The ion exchange treatment unit requires four Contractor supplied ancillary systems. The bulk caustic storage system includes 1,250 gallon storage tank D 208 and associated valves and controls. The bulk acid storage system includes 2,500 gallon storage tank D 209 and associated valves and controls. The neutralization system collects spent regenerant and slow rinse solutions in 5,000 gallon tank D 210 for pretreatment and transfer to final treatment and disposal. Finally, the clean water storage system provides storage for treated effluent in 15,000 gallon storage tank D 204. This

water is used in the ion exchange treatment unit for backwashing chemical dilution, and rinsing

1 2 PROCESS INSTRUMENTATION CONTROL & MONITORING FUNCTIONS

The overall function of the Instrumentation Control and Monitoring System shall be to provide an efficient control and monitoring interface between plant operations and treatment processes by presenting visual and audible information of plant operating parameters equipment status and wear, and alarm conditions It provides automatic control of critical parameters or parameters which would require frequent operator attention The systems shall provide means for manual override operation of any automatic function when required and shall permit control of the operation of motors and valves that are pertinent to satisfactory process performance The system shall provide the following described functions in accordance with the process and instrumentation diagrams (I Drawings)

- A Included herein are functional descriptions of the process instrumentation and control systems which specify the responsibility of the Process Instrumentation Control & Monitoring System Supplier These descriptions are to supplement the Process and Instrumentation Drawings and neither is complete without the other If the ICM Subcontractor requires devices other than shown on the Drawings and/or specified herein to achieve the result required by the system description provide these devices to obtain the required result
- B The intent of these Specifications is to secure systems that have 4 20 mAdc analog signals between control panels and field devices throughout the plant except where specified otherwise
- C The systems descriptions herein cover all processes in general even though no specific ICM work is required in a given system These descriptions are provided for completeness and to indicate the relationship of the ICM work to other divisions Where specific functions are described as to be performed under the Electrical Division they shall be as binding upon the Contractor as if written in the Electrical Division Sections

1 3 SYSTEM DESIGNATIONS

The Drawings and system descriptions are divided by system designations as shown on the Drawings All equipment numbers utilizing these designations and systems are described in the indicated order In the following descriptions where no ambiguity should result from dropping a portion of the designation prefixes, the numbers will be abbreviated for convenience Hyphens in numbers may be omitted unless required to distinguish between two otherwise similar numbers such as FV11 1 and FV1 11 Hyphens in designations on the drawings have no significance other than to distinguish

between letters and numerals or to otherwise increase clarity
Refer to Drawing 38548 005 for a complete listing of abbreviations
and symbols

- A Instrumentation Control, And Monitoring Philosophy The instrumentation control and monitoring equipment for the 881 Hillside treatment facility as described herein is based on providing sufficient measurement indication and/or automatic control to enable process operation within the design criteria. Automatic control loops are specified only where necessary and include manual bypass control options. Adequate monitoring equipment is specified to permit complete process operational management and evaluation and for operator protection. In general, automatic controls are confined to level, time, temperature, flow, and flow direction. Other more sophisticated controls may be included in some packaged systems.

The overall ICM philosophy includes both local automatic control of some systems at a field panel (FP) as well as overall automatic control and monitoring by a programmable logic controller (PLC) located in the main control panel (MCP). Except as noted, all analog inputs, status, and alarm signals shall be connected to the appropriate PLC I/O in the MCP as shown on the Drawings. All controller functions, receiver switch functions, alarm functions, and annunciator functions shall be performed by the PLC. All external telemetry shall be performed by the PLC as well.

B Automatic Motor Control

- 1 Automatic Operation Except when specifically described otherwise, all motors specified for automatic operation shall be provided with HAND OFF AUTO (H O A) selector switches. In the HAND position, the motor shall operate continuously and automatic interlock, if any, shall be bypassed. In the OFF position, the motor shall be stopped. In the AUTO position, operation of the motor shall be dependent on the status of the output contact of the control circuit to be described for the individual equipment.
- 2 Automatic Standby Operation When specified for automatic standby, motors in multiple unit systems shall also be provided with either a DUTY STANDBY (D S) selector for automatic motors with H O A switches or HAND OFF STANDBY (H O S) switches for manually operated motors without H O A switches.
 - a Automatic motors with selectors on AUTO and DUTY shall be controlled by the automatic control circuit; those selected for AUTO and STANDBY shall operate only if a DUTY motor fails to respond.

- b The standby function shall be inoperative when the H O A selector is in HAND or OFF For manually operated motors with H O S switches motors selected for STANDBY shall operate if a motor selected for HAND fails to operate

PART II DETAILED SYSTEM DESCRIPTION

2 1 GROUNDWATER COLLECTION WELL

- A General A groundwater collection well is used to collect ground water from a portion of the 881 Hillside area The collected water is pumped to the influent storage tanks This well and ancillary equipment will be constructed as part of Phase IIB The following information is for reference only The well pump shall be controlled by the PLC based on input signals received from remote monitoring and control devices in the well and the storage tanks From the signal inputs the PLC shall generate and transmit signals as required to start and stop P 100 General ICM requirements for the collection well shall include the following
 - 1 Measure the flowrate (FE 100), indicate and totalize flow locally (FQI 100A), transmit (FIT 100) and totalize flow at the MCP (FQI 100B)
 - 2 Indicate P 100 status locally at FP 100 (OL 100A) and at the MCP (OL 100B)
 - 3 Alarm P 100 failure locally at FP 100 (OA 100A) and at the MCP (OA 100B)
- B Manual Control Mode This mode of control allows a plant operator to start and stop P 100 as follows
 - 1 P 100 shall be controlled at the MCP by a HAND/OFF/AUTO hand switch (HS 100B) When HS 100B is in the Auto position P 100 shall be controlled by the PLC When HS 100B is in the OFF position, P 100 shall be off When HS 100B is in HAND, P 100 shall run
 - 2 The JOG/OFF/AUTO switch (HS 100A) on FP 100 shall still be able to activate P 100 when HS 100B is in the OFF position When HS 100A is in the OFF position it shall override control by the PLC regardless of the position of HS 100B
- C Normal Automatic Control P 100 shall be automatically controlled by the PLC when HS 100B is in the AUTO position The requirements for this control are as follows

- 1 Well level shall be measured (LE 100 LIT 100) and P 100 started on high level (LSH 100) and stopped on low level (LSL 100)
- 2 The destination tank for P 100 is selected manually by the operator by opening D 201 or D 202 inlet valves HV 201A or HV 202A respectively P 100 shall be prevented from starting unless there is a proper pumping path and the tank selected for filling is not full [Section 2 4(B)(1)(d) and 2 4(B)(3)(a)]
- 3 P 100 shall be stopped upon a complete system shutdown initiated by the PLC

2 2 COLLECTION SUMPS

A General The collection sumps are used to collect ground water at low points in the french drain system The collected water is pumped to the influent storage tanks by pumps P 101 P 102 P 103 P 104 P 105 and P 106 These pumps shall be controlled by the PLC based on input signals received from remote monitoring and control devices in the sumps and the storage tanks From the signal inputs the PLC shall generate and transmit signals as required to start and stop the pumps General ICM requirements for the collection sumps shall include the following

- 1 Measure the flowrate (FE 101 FE 103 FE 105) indicate and totalize flow locally (FQI 101A FQI 103A, FQI 105A) transmit (FIT 101, FIT 103, FIT 105) and totalize flow at the MCP (FQI 101B, FQI 103B, FQI 105B)
- 2 Indicate the respective pump status locally at FP 101 FP 103 and FP 105 (OL 101A, OL 102A OL 103A OL 104A, OL 105A, OL 106A) and at the MCP (OL 101B OL 102B, OL 103B OL 104B OL 105B OL 106B)
- 3 Alarm pump(s) failure locally at FP 101 FP 103, FP 105 (OA 101A, OA 102A, OA 103A, OA 104A, OA 105A, OA 106A) for the respective pump and at the MCP (OA 101B OA 102B OA 103B OA 104B OA 105B OA 106B)

B Manual Control Mode This mode of control allows a plant operator to start and stop the collection sump pumps as follows

- 1 The pumps shall be controlled at the MCP by HAND/OFF/AUTO switches (HS 101B, HS 102B, HS 103B HS 104B HS 105B HS 106B) When HS 10XB is in the HAND position, P 10X shall operate independent of any output from the PLC When HS 10XB is in the OFF position, P 10X shall be off

- 2 The JOG/OFF/AUTO switch (HS 101A HS 102A HS 103A HS 104A HS 105A, HS 106A) on FP 101 FP 105 and FP 103 shall still be able to activate the pumps when HS 10XB is in the OFF position When HS 10XA is in the OFF position it shall override control by the PLC regardless of the position of HS 10XB
- C Normal Automatic Control The collection sump pumps shall be automatically controlled by the PLC when HS 10XB is in the AUTO position The requirements for this control are as follows
- 1 Sump level shall be measured (LE 101 LIT 101 LE 103, LIT 103, LE 105, LIT 105), and the lead pump, P 101, P 103 P 105, started on high level (LSH 101, LSH 103 LSH 105) and stopped on low level (LSL 101 LSL 103 LSL 105) The lag pump, P 102, P 104, P 106 shall be started on increasing level, and both pumps stopped on low level
 - 2 An alternator circuit shall be provided in the PLC to switch the lead and lag pump after each use and on pump failure
 - 3 The destination tank for the collection sump pumps is selected manually by the operator by opening D 201 or D 202 inlet valves, HV 201A or HV 202A respectively The pumps shall be prevented from starting unless there is a proper pumping path and the tank selected for filling is not full [Section 2 4(B)(1)(d) and 2 4(B)(3)(a)]
 - 4 The collection sump pumps shall be stopped upon a complete system shutdown initiated by the PLC

END OF SECTION 17050

SECTION 17100
PRIMARY ELEMENTS

PART I GENERAL

1 1 DESCRIPTION This Section specifies primary elements of process instrumentation auxiliary equipment and supplies directly related to the installation of and operation of these primary elements to perform the required functions in conjunction with information and equipment specified in other ICM Sections Schedules indicating required information are attached at the end of this Section but shall not be construed as Bills of Material or as a complete listing of all required devices

1 2 QUALITY ASSURANCE

- A Manufacturer In addition to the requirements of Section 17000, instrumentation and controls equipment furnished shall be manufactured by a firm regularly and currently engaged in the design and manufacture of similar equipment All equipment furnished shall be new and of current design
- B Maintainability All equipment shall be designed for ease of maintenance and repair and access to critical parts shall not require a major disassembly Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover
- C Materials and Installations Materials and installations shall comply with the requirements of the current editions of referenced electrical codes and standards and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed All equipment of the same type shall be products of the same manufacturer capacities of all equipment shall not be less than that indicated on the Drawings or specified

PART II. PRODUCTS

2 1 LEVEL SENSORS

- A Radio Frequency Type Level Sensors Unit shall employ an admittance measurement technique using low power RF to measure the level of a product in a grounded vessel The sensing element shall be the immersion type with mounting suitable for installation shown Sensing element shall be Teflon coated and shall be constructed so as to be unaffected by coating build up The sensing element shall be interconnected to an

indicating transmitter by an integral cable with length as shown (100 ft max) Sensor and interconnecting cable shall be intrinsically safe in accordance with NFPA 493

Indicating transmitter shall be suitable for pipestand or wall mounting with a NEMA 4X enclosure The indicating transmitter shall output a 4-20mA signal linearly proportional to the level, into a 400 ohm load impedance without load adjustments Output span and zero shall be field adjustable 0-30 seconds measured RFI filters shall be provided as required to eliminate extraneous interference effects Indicator shall be 3 inch scale minimum visible from outside the unit and shall be linearly graduated with scale range as noted Overall system accuracy shall be ± 1.0 percent of full scale for sensing element temperatures to 200 degrees F and 150 psig pressure

- B Manufacturer The unit shall be a Drexelbrook type 508 Level Measuring System For fiberglass tank service, the unit shall include a ground reference electrode No substitutions are permitted

2.2 PROPELLER METERS

- A The propeller shall be constructed of rigid plastic that will not flex or otherwise change in dimension under maximum fluid velocity through the meter Meters shall be in line type of cast iron or steel neoprene or epoxy lined Each propeller meter shall register flow to a guaranteed accuracy of plus or minus 2 percent throughout the maximum to minimum flow ranges listed in the Schedule
- B Meters shall be manufactured to comply with all applicable requirements of AWWA C704 All meters shall mate with 150 pound flanges unless otherwise shown on the Drawings Straightening vanes shall be furnished and installed upstream from the meter according to the manufacturer's recommendations The impeller shaft, bearing spacers and seal sleeve shall be Type 316 stainless steel Ball bearings, shall be Type 440 C with all stainless balls race and retainers The thrust bearing, carbide pad and point shall have Rockwell hardness of C 90 or better
- C The meter shall generate a scaled pulse rate The unit shall be a two wire device powered from the MCP
- D Propeller meters shall be manufactured by Sparling McCrometer, Brooks Rockwell or equal

2 3 SCHEDULES (SEE ATTACHED)

PART III EXECUTION

Installation testing and start up shall be in accordance with
Section 17000 of these specifications

END OF SECTION 17100

17100 3

SECTION 17220
LEAK DETECTION SYSTEM

PART I GENERAL

1 1 DESCRIPTION Requirements of Division 1 and Section 17000 form a part of this Section. This Section specifies the panel mounted and miscellaneous field instruments and equipment to perform the required functions in conjunction with information and equipment specified in other Sections of Division 17.

A Unit Responsibility It shall be the responsibility of ICM Subcontractor as described in Section 17000 of this Division to insure that the instruments and equipment furnished under this Section are compatible with the equipment furnished under other sections of this Division and other Divisions of these Specifications and that the signal transmission methods are compatible.

B Case colors shall be compatible with the panel colors and subject to final approval by the Buyer. Normally compatible standard colors of the manufacturer shall be acceptable.

1 2 QUALITY ASSURANCE

A Manufacturer In addition to requirements of Section 17000 instrumentation and monitoring equipment furnished shall be manufactured by a firm regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of the most recent design.

B Maintainability All equipment shall be designed for ease of maintenance and repair and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C Materials and Installation shall comply with the requirements of the current editions of referenced electrical codes and standards and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Drawings or specified.

PART II PRODUCTS

2 1 LEAK DETECTION SYSTEMS

A General The leak detection systems shall be provided as specified herein and/or on the Drawings. The systems shall continuously monitor the double wall piping installations for leakage of water contaminated or otherwise. The system shall be comprised of a remotely located sensing element and an existing PLC 1 located in the main control panel. The MCP shall provide audible and visual alarms.

B Liquid Level Sensors

1 General Description The sensor shall be capable of detecting a minimum of 0.5 inches of water collected in the annular space between the primary and secondary pipe walls which drains to the collection and draw off sump in the manhole as shown on the Drawings.

2 Specific Requirements

a The sensors shall be suitable for PP pipe and fittings as shown on the Drawings.

b The sensor shall be mounted on the bottom of the collection and the drawn off sump as shown on the Drawings.

c The sensor shall be suitable for remote mounting up to 1000 feet from the leak monitoring panel.

d Cable from the sensor to the leak monitoring panel shall be suitable for direct burial.

3 Construction The sensors shall be UL listed and suitable for installation in a Class 1 Division 1 Group D areas.

4 Electrical Power Requirements The liquid level sensors shall be powered by individual isolated power supplies located in the main control panel.

a The monitoring panel shall have an intrinsically safe power supply including intrinsically safe barriers to all sensors.

5 Electrical Power Requirements The leak monitoring panel shall operate from standard electrical power utilities furnishing 120 Vac 60 Hz single phase service.

The sensors shall be connected to the existing PLC 1 located in the MCP via the intrinsic safety barriers. An Allen

Bradley 2U VDC input card shall be furnished as part of this contract. Rosemount individual loop power supplies shall be furnished for each loop.

PLC 1 shall be programmed to trip one of the spare annunciator windows in the MCP upon detection of a leak. The ICM contractors shall provide any necessary wiring.

C Manufacturer The Leak Detectors shall be Ronan model LS 3

Part III EXECUTION

Installation testing and start up shall be in accordance with Section 17000 of these Specifications.

END OF SECTION 17220

DOCK LOADING CONTAINMENT CURB

B KELSU

1-9-91

CONTAINMENT

VOLUME REQ'D

USE 10,500 gals TANK TRAILER (NOTE LARGEST TANKER MANUFACTURED 1950
 ADD 10% FOR RAINFALL 9500 gals IS LARGEST TREE
 LEGAL & COLD - 10)

$$111 = 11,550 \text{ gals} \quad \text{or} \quad 1538 \text{ cu ft}$$

$$\text{WIDTH} = 15 - 8 \times 2 \quad 13'8" - 16'$$

LENGTH USE 60

$$\text{SURFACE AREA} = 60' \times 13.7 = 822 \text{ sq ft}$$

$$\text{WALL HEIGHT} = 1.75' \times \frac{1}{1.75} = 1.87' \quad \text{USE } 2' \text{ HIGH}$$

COLLECTION SURF VOLUME

$$1/2 \text{ SE } 1 \times 1 \times 3 \text{ cu ft}$$

$$\text{VOLUME} = 27 \text{ cu ft}$$

$$\text{DOCK SURFACE AREA} = 15 \times 75 = 1125 \text{ sq ft}$$

RAINFALL EVENT STORAGE CAPACITY

$$\text{RAINFALL FILT} = 27 \text{ cf} / 1125 \text{ sq ft} = 0.02' \text{ or } 1/4" \text{ RAINFALL}$$

ADD 2' H.E.

EG & G ROCK FLATS
881 HILLIDE REMEDIATION DESIGN - PHASE II B
SELECTION OF GEOMEMBRANE MATERIAL

DE07508
KENT A FRIESEN
JEB

1 4
1/15/17

PURPOSE SELECT & JUSTIFY THE TYPE AND THICKNESS OF GEOMEMBRANE MATERIALS FOR COLLECTION (COLLECTOR) TANKS, PITS

CONSIDERATION: THE MOST COMMON MATERIALS ON THE MARKET FOR GEOMEMBRANE LINERS ARE HDPE, PVC AND LLDPE. REGULAR STANDARD FOR MINIMUM THICKNESS OF LINER AND CAP AREA PROTECT IS 30 MIL (0.30 INCH) ✓

MATERIAL TYPE

CHEMICAL CONSIDERATIONS THE COLLECTED FLUID THREAT, BE CONTACT WITH THE CUTOFF WALL CONSISTS OF WATER (1) AND (2) WITH DISSOLVED CHLORINATED SOLVENTS - MAXIMUM PHASE (1) SOLVENTS ARE NOT EXPECTED TO BE ENCOUNTERED, THEREFORE ALL THREE TYPES OF LINER MATERIAL ARE COMPATIBLE

(REF: REMEDIATION INVESTIGATION REPORT 881 HILLIDE)

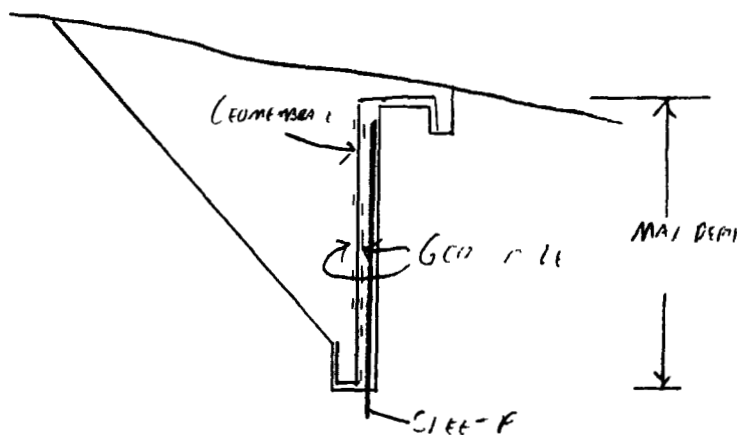
STRENGTH CHARACTERISTICS ALTHOUGH HDPE AND LLDPE TEND TO BE CREEPER 1 DIMENSIONAL ULTIMATE STRENGTH THAN PVC, PVC HAS THE ADVANTAGE TO BE SUPERIOR 3-DIMENSIONAL STRENGTH CAPABILITY PVC HAS NOT HAD A HISTORY 3D STRESS VALUE, P HAS BEEN TESTED WITH HIGH STRAIN IN 3 DIMENSIONAL STRESS TESTING WITHOUT FAILURE UNLIKE HDPE AND LLDPE (REF: KERN, 1990 DESIGNING WITH GEOTEXTILES)

IT IS LIKELY THAT IRREGULAR SURFACES WILL RESULT ALONG THE SHEET PILING DURING CONSTRUCTION THEREFORE, PVC IS A BETTER CHOICE BASED ON SUPERIOR 3D STRENGTH CAPABILITY. IN ADDITION IT IS KNOWN FROM EXPERIENCE THAT HDPE IS SOMEWHAT BRITTLE AND TENDS TO FAIL ALONG SHARP CORNERS, SUCH AS AT THE BOTTOM OF THE PLASMA CUTOFF WALL PVC IS MORE FLEXIBLE AND NOT AS SUSCEPTIBLE TO STRESS CRACKING HERE

SELECTION PVC / ✓

2 4
1/14/91

SCHEMATIC DRAWING OF
CUT 1' x 1'



ALLOWANCE SH = 2000 pr / 20 - 1000 pr

A diagram of a vertical pipe section. At the top, a horizontal line represents the pipe's cross-section, with a label "6 ft outside diam." above it. Below this, a vertical line represents the pipe's length. On the left side of the vertical line, there is a label "F d" and "Res" with a subscript "1". On the right side, there is a label "T₁" and "K" with a subscript "1". A horizontal arrow labeled "N" points to the right from the left side of the vertical line. A horizontal arrow labeled "H" points to the left from the right side of the vertical line. At the bottom of the vertical line, there is a downward arrow labeled "F". Below the downward arrow, there is a label "3 ft" with a double-headed vertical arrow indicating a distance.

E606 ROK, FLAT
891 HILL at REMEDIAL DESIGN PHASE II
SELECTION OF CONTEMPORARY MATERIAL

DE 075 DV
KENT A FRIE
MEB

- 4
1/1/10

FIND VALUES TO ENTER INTO EQ (1)

ALLOWABLE STRESS 1000 psi (assumed)

PRESSURE - MAXIMUM ALLOWABLE PRESSURE, $= \frac{(1000 \text{ psi})}{(M.S.F.)}$
→ A CONSERVATIVE VALUE FOR PRESSURE
VARIES FROM ZERO TO A MAX VALUE

$\phi_1 = 17^\circ$ FROM KOERNER, PG 284 PVC OR 1 CL SP

$\phi_2 = 17^\circ$ (CONSERVATIVE, SOME PORTION OF DRAIN WILL BE
COVERED BY LINER W/ TIME FACTOR 1.0)

ΔH = 3 INCHES

SOIL DEN IS 125 lb/ft³ - ALL FROM OCTO
DRAIN GEOTECHNICAL INFO 6 -

MAX DEPTH 25 FT. COLL. TO TOP OF

SOLVE EQ (1) FOR LINER THICKNESS

$$t = \frac{(125 \text{ lb/ft}^3)(25 \text{ ft})(\tan 17^\circ + \tan 17^\circ)(3 \text{ in.})\left(\frac{1 \text{ ft}^2}{41}\right)}{(1000 \text{ lb/ft}^2)}$$

$$t = 0.0398 \text{ INCH} = 398 \text{ mil}$$

USE 40 MIL PVC MATERIAL

CHECK IF 1" FRITL WILL HOLD DOWN WEIGHT

DEFINITION PVC 169 (KOERNER PG 6-)

$$\begin{aligned} \text{1 FT WIDTH OF LINER WEIGHS } & (169)(62.4 \text{ lb/ft}^3)(1 \text{ ft})(25 \text{ ft})\left(\frac{0.40}{12} \text{ ft}\right) = 879 \text{ lbs} \\ \text{ALLOWABLE WT (BASED ON 1000 psi)} & (1000 \text{ lb/ft}^2)(0.40 \text{ in})(12 \text{ in}) = 480 \text{ lbs} \end{aligned}$$

OK

E6+6 RULY, FLA

881 MILLER RD. OF THE 6th PINE #13

SELECTION OF GEOMEMBRANE MATERIAL

DE07508

KENT A. FRILSEN

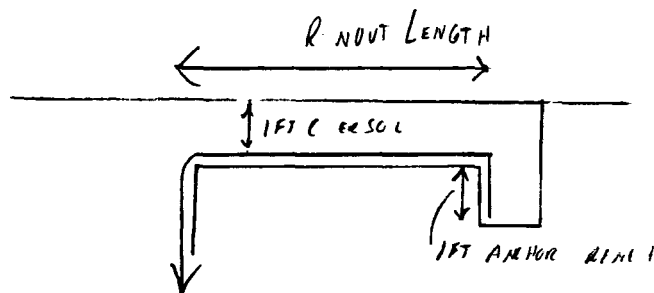
MFB

4 4

1/2

ANCHOR TRENCH REQUIREMENTS

ASSUME DE 16" OF ANCHOR TRENCH 1 FT DEEP, W
1 FT OF COVER SOIL FINE RUNOUT LENGTH



USE EQUATION FROM PAGE 428 OF KOERNER BOOK

$$T_{ALLOW} = F_L + 2 F_{AT}$$

$$T_{ALL} = (\text{ALLOWABLE STRESS}) \\ = (4 \times 879 \text{ lbs/ft}) = 352 \text{ lb/ft}$$

(BY SETTING THIS ALLOWABLE STRESS ANCHOR TRENCH WILL SURVIVE
4 TIMES THE WEIGHT OF THE LINER HOWEVER MAX TENSILE TREATMENT
IS NOT REALIZED (480 lbs/ft) SO LINER WILL PULL OUT BEFORE TENSILE

$$F_L (\text{SURCHARGE PRESSURE}) (\tan \theta) (\text{RUNOUT LENGTH})$$

WHERE θ IS THE SOIL FRICTION ANGLE
(USE 17° FROM KOERNER, PAGE 84)

$$\text{ALSO USE SOIL DENSITY} = 125 \text{ lb/ft}^3$$

$$\text{SOIL FRICTION ANGLE} = 32^\circ$$

(FROM FRENCH DIA GRAPH (1/11))

$$F_L (125 \text{ lb/ft}^3) (1 \text{ FT}) (\tan 17^\circ) (X) \\ = (382 \text{ lb/ft}^2) X$$

$$F_{AT} = (1 - \sin \theta) \gamma_s (\text{WEIGHT OF ANCHOR TRENCH}) \tan \theta (\text{DEPTH OF ANCHOR TRENCH}) \\ (1 - \sin 32^\circ) (125 \text{ lb/ft}^3) (1 \text{ FT}) (\tan 17^\circ) (1 \text{ FT}) = 180 \text{ lb/ft}$$

SOLVE FOR X

$$(352 \text{ lb/ft}) - (382 \text{ lb/ft}^2) X + 180 \text{ lb/ft}$$

$$X = 45 \text{ FT, SET RUNOUT AT 1 FT WILL BE ADEQUATE}$$

EG & B ROAD FLATS
481 HILLSIDE REMEDIATION DESIGN PHASE IIB
SELECTION OF GEOTEXTILE MATERIAL

DE07508
KENT AFR
7523

1/11/03

For this SPECIFIC TYPE, THICKNESS AND PERMEABILITY OF
GEOTEXTILE MATERIAL FOR USE IN THE COLLECTION OF

ASSUMPTION A NONWOVEN GEOTEXTILE WILL BE REQUIRED
FUNCTION OF THE GEOTEXTILE INCLUDE DRAINAGE, SEPARATION
OF DRAIN ROCK FROM NATIVE CLAY SOIL, AND PROTECTION OF
GEOMEMBRANE CUTOFF WALL

PROTECTION OF GEOMEMBRANE WILL BE DIFFICULT TO ACHIEVE
SINCE THE AREAS OF CONCERN ARE POSSIBLY IRREGULAR IN
IN THE CUTOFF WALL (WHICH WILL BE KNOWN TO BE IRREGULAR)
AND PROTECTION DURING BACKFILLING OF THE CUTOFF WALL
(WHICH IS NOT QUANTIFIABLE AT PRESENT) THEREFORE
DESIGN BASIS WILL INCLUDE DRAINAGE AND SEPARATION FUNCTIONS
AND THE REQUIRED GEOTEXTILE WILL ALSO BE APPLIED TO
THE PROTECTIVE GEOTEXTILE

APPROACH SPECIFICATIONS FOR GEOTEXTILE WILL BE BASED ON THE
AASHTO TASK FORCE #25 SPECIFICATIONS FOR GEOTEXTILE THE TASK
FORCE 25 SPECS HAVE BEEN APPROVED BY WORKING COMMITTEE AND
ARE WIDELY RECOGNIZED AS APPROPRIATE FOR USE IN DESIGN
BASED ON THE STANDARD TASK 25 SPECS FOR DRAINAGE
GEOTEXTILES CALCULATIONS WILL BE PERFORMED REGARDING
SOIL RETENTION, WATER PERMEABILITY, PUNCTURE STRENGTH,
BURST RESISTANCE & TEAR RESISTANCE UNDER FIELD SPECIFIC
FIELD CONDITIONS @ 481 HILLSIDE, AND THE DEGREE OF
PROTECTIVENESS (GENERAL FACTOR OF SAFETY) WILL BE EVALUATED

REFERENCES

CALCULATIONS BASED ON KOERNER, 1990 DESIGNING WITH GEOSYNTHETICS

TASK FORCE 25 SPECIFICATION GUIDE IS REPRINTED IN APP C OF KOERNER'S
BOOK, AN UPDATED SPEC BASED ON TASK FORCE 25 IS AVAILABLE
FROM NILLI CORPORATION OF ENGLEWOOD, CO

EG & G REXILL

881 Hill de Remedios Drive Phase II

SELECTION OF GEOTEXTILE MATERIAL

DE 07508

KENT A FRIESE

MEC

2 3

1/11

SOIL RETENTION

TAK FORD 25 RECOMMENDS THAT FOR A MINIMUM OF 50% PASSING THE NO 200 SIEVE (i.e. CLAY SOILS TYPICAL OF HILLSIDE), THE APPARENT OPENING SIZE (AOS) OF THE GEOTEXTILE SHOULD BE \geq NO 50 SIEVE SIZE

OTHER APPROACH PC 122 OF KURNER NOTES

$O_{95} < (2.0 \pm) d_{95}$

↑ FROM AOS opening size (mm)

↑ d_{95} IS SIZE WHICH 85% OF PARTICLES IS FINE

ABOVE LABORATORY SAMPLES WITH SIEVE DATA

| <u>PORE</u> | <u>DEPTH (ft)</u> | <u>d_{95}</u> ↑ FROM APP B1 OF FRIESE |
|-------------|-------------------|--|
| B306590 | 10 6 113 | 0.15 mm |
| B306790 | 60 63 | 0.05 mm |
| B303790 | 53 63 | 2.0 mm |
| B30790 | 107 112 | 0.08 mm |
| B304090 | 45 55 | 0.025 mm |
| B304190 | 40 45 | 0.10 mm |
| B304290 | 88 95 | 0.045 mm |
| B304290 | 167 176 | 0.95 mm |
| B301290 | 208 217 | <u>0.055 mm</u> |

Average $d_{95} = 0.38 \text{ mm}$, max $d_{95} = 0.045 \text{ mm}$

Avg $O_{95} < (2.0 \pm) (0.38 \text{ mm}) = 0.77 - 1.14 \text{ mm} \rightarrow$ NO 30 TO NO 10 \pm 16% SIZE

MIN $O_{95} < (2.0 \pm) (0.045) = 0.09 - 0.135 \text{ mm} \rightarrow$ NO 200 TO NO 100 SIEVE SIZE

USE NO 100

EG+6 ROCK FLATS
 981 HILLSIDE REMEDIAL DESIGN PHASE IIB
 SELECTION OF GEOTEXTILE MATERIAL

DE 07508
 KENT A FIRESEN
 TIME 23

3 5
 1/11/91

WATER PERMEABILITY

TAKE FORCE 25 RECOMMENDS USING A FABRIC THAT HAS
 A GREATER HYDRAULIC CONDUCTIVITY THAN THE NATURAL

SOIL HYDRAULIC CONDUCTIVITY = 3×10^{-5} TO 5×10^{-4} cm/sec
 FOR COLLUVIUM MATERIAL (SAND/CLAY)
 (REF RI REPORT FOR HIGH PRESSURE, SITE 88)
 HILLSIDE AREA, VOL III, MARCH 1987

Permeability is the index property for geotextiles and is
 defined as

$$\text{Permeability} = \frac{K (\text{hydraulic conductivity})}{t (\text{fabric thickness})}$$

THICKNESS OF POLYESTER GEOTEXTILE (D 100 TO D 160) GUNITE
 TYPICALLY RANGE FROM 55 TO 160 MILS. THIS APPLICATION
 WILL ASSUME A LIGHTWEIGHT FABRIC RANGING FROM 55 TO
 100 MILS IN THICKNESS

PERMEABILITY RANGE $\frac{3 \times 10^{-5} \text{ cm/sec}}{(0.100 \text{ in}) (2.54 \text{ cm/in})} = 1.2 \times 10^{-4} / \text{sec}$ LOW RANGE

$\frac{5 \times 10^{-4} \text{ cm/sec}}{(0.055 \text{ in}) (2.54 \text{ cm/in})} = 3.6 \times 10^{-3} / \text{sec}$ HIGH RANGE

NOW, CONSIDER SAME SITUATION WITH ESTIMATED K of gravelly colluvium

Assume K 10^{-3} cm/sec $t = 55 \text{ to } 160 \text{ mils}$

Permeability $\frac{1 \times 10^{-3} \text{ cm/sec}}{(0.100) (2.54 \text{ cm/in})} = 3.9 \times 10^{-3} / \text{sec}$ LOW RANGE

$\frac{1 \times 10^{-3} \text{ cm/sec}}{(0.055) (2.54)} = 7 \times 10^{-3} / \text{sec}$ HIGH RANGE

SET A HIGH PERMEABILITY OF $0.5 / \text{SEC}$ FS - $\frac{0.5}{10^{-3}} = 70$

EGG ROCK FLATS
881 HILLSIDE REMEDIAL DESIGN PHASE
SELECTION OF GEOTECHNICAL MATERIAL

DE 07508
KEN A FRENCH
MFB

4 5
1/14/91

PUNCTURE STRENGTH

TASK 25 REQUIREMENT ON 11 80 lb, ALL TO ASTM D 4833

CALCULATION BASED ON Eq 2.26, pg 15 OF KOERNER 1960,

$$(2.26) F_{\text{PVT}} = [\pi d_h] (h_h p') S'$$

WHERE F_{PVT} REQUIRED PUNCTURE FORCE

d_h - AVG DIAMETER OF HOLE, ALL C'S
APPROX 1" DIA
DIAMETER OR 0.675

h_h PROPOSED HOLE DEPTH
0.675 IN AGGREGATE

p' PRESSURE EXERTED ON AGGREGATE
APPROXIMATED AS MAX EARTH CO
PRESSURE OR γ (DEPTH)

S' SHAPE FACTOR, VARIES FROM 0.3 FOR
ROUND GRAVEL, TO 0.7 FOR OR
AGGREGATE (PG 132, KOERNER)

ASSUMING ROUND AGGREGATE

$$F_{\text{PVT}} = \pi (0.675 \text{ in}) (0.675 \text{ in}) (125 \frac{\text{lb}}{\text{ft}^3}) (25 \text{ ft} / 10.3) (\frac{1 \text{ ft}^2}{144 \text{ in}^2})$$

$$= 93 \text{ lbs} \checkmark$$

ASSUMING ANGULAR AGGREGATE

$$F_{\text{PVT}} = \pi (0.675) (0.675) (125) (25) (0.7) (\frac{1}{144})$$

$$= 22 \text{ lbs} \checkmark$$

80 lb - SPEC IS OK

FACTOR OF SAFETY IS $80/93 = 0.86$ FOR ROUND AGGREGATE
AND $80/22 = 3.6$ FOR ANGULAR ROCK

SPECIAL ROUND DRAIN ROCK FOR GREATER FS

E606 ROCKY FLATS
881 HILLSIDE MEMORIAL DESIGN PROJECT
SELECTION OF GEO TEXTILE MATERIAL

DE 07508
KENNETH A. FRIEDMAN
JUL 13

5 5
1/14/01

BURST RESISTANCE

CHECK BURST RESISTANCE OF DRAIN ROCK ON GEOTEXTILE
TASK FORCE 25 SPECIES 290 lb/ft², Muller E. test

FROM PAGE 127 OF KOERNER BOOK

$$T_{reqd} = p' d_v$$

WHERE T_{reqd} REQUIRED SUBC STRENGTH

p' STRESS @ SUBC - 0.11 - 7 (max stress)
 d_v MAX VOID DENSITY ≈ 0.4 (1.4 - 0.4)

$$T_{reqd} (25 \text{ lb/ft}^2) (25 \text{ ft}^2) (0.4) (1.4) = 141 \text{ lb/ft}^2$$

TO COMPARE WITH MULLER E. TEST (pg 128 of Koerner)

$$\text{BURST PRESSURE} = \frac{T_{reqd}}{d_{test}}$$

$$\text{WHERE } d_{test} = \text{BURST TEST DENSITY} = 1.2 \text{ in}^3/\text{ft}^3$$

$$\text{BURST PRESSURE} = \frac{59 \text{ lb/ft}^2}{1.2 \text{ in}^3/\text{ft}^3} = 49 \text{ lb/ft}^2$$

$$\text{FACTOR OF SAFETY} = \frac{290 \text{ lb/ft}^2 (\text{SPECIFIED})}{49 \text{ lb/ft}^2} = 5.9$$

SPEC IS ADEQUATE

GEOTEXTILE WEIGHT

(NOT SPECIFIED IN TASK FORCE 25) - WHAT WEIGHT OF MATERIAL TYPICALLY MEETS TASK FORCE 25 SPECS?

POLYFECT - 7 oz/YARD, EXCEPT MODIFIED AOS REQ, MAY NEED 10 oz/YD

AMOCO - FABRIC 4553, WHICH IS 8.6 oz/YARD, EXCEPT FOR MODIFIED

AOS REQUIREMENT, NONE QUILT MATCH

QUALITY ACCEPTANCE CRITERIA CHECKLIST (QACC)

(PER FACILITIES ENGINEERING PROCEDURE NO DES-18)

MWO/AUTH NO 986147

BLDG 891

JOB TITLE Building 881 Hillside Remedial Action, Phase IIB

PROJECT ENGR Mike Freehling

EXT 7743 DATE 1-18-91

| ITEM/DESCRIP | ACCEPTANCE CRITERIA | RESP DEPT | DATE COMPLETED | PASS FAIL | INSP INIT | REMARKS |
|----------------------------|---|-----------|----------------|-----------|-----------|---------------------------|
| 1 Health Sciences Measures | *Sec 01106 a c | ER | | | | *Phase IIB Specifications |
| 2 Trench Safety | *Sec 02200-1 2B OSHA 29CFR 1926P | FI | | | | |
| 3 Backfill Compaction | *Sec 02200-3 1F 3 8ASB ASTM D-698, D-1557 D-1556 & D-2922 | FI | | | | |
| 4 Concrete Formwork | *Sec 03100-1 3 OSHA 29CFR 1926.701 | FI | | | | |
| 5 Concrete Formwork Design | *Sec 03100-3 1 ACI Standard 347 | FI | | | | |
| 6 Concrete Reinforcement | *Sec 03200-1 3A 2.1 ACI Standard 315 | FI | | | | |
| 7 Concrete | *Sec 03300-1 4CZ ACI Std. 211.1, 306, 318, 304 ASTM C-150 C-33 C-260 D-1752 C-171, C-309 | FI | | | | |
| 8 Grout | *Sec 03601-2 1 ASTM C-150, C-33 | FI | | | | |
| 9 Paint | RFP Standard SC-110 *Sec 09900-1 1 | FI | | | | |
| 10 Equipment Leveling | *Sec 15050-3 1F ASME B.5.16 | FI | | | | |

QUALITY ACCEPTANCE CRITERIA CHECKLIST (QACC)

(PER FACILITIES ENGINEERING PROCEDURE NO DES-18)

MWO/AUTH NO 986147

BLDG 891

JOB TITLE Building 881 Hillside Remedial Action, Phase IIB

PROJECT ENGR Mike Freehling
EXT 7743 DATE 1-18-91

| ITEM/DESCRIP | ACCEPTANCE CRITERIA | RESP DEPT | DATE COMPLETED | PASS FAIL | INSP INIT | REMARKS |
|----------------------------|---|-----------|----------------|-----------|-----------|---------------------------|
| 11 Piping - CPVC | RFP Std SP-211 SP-220(3.8,3.43,3.50), SP-301 SC-107 | FI | | | | *Phase IIB Specifications |
| 12 Electrical Tests | *Sec 16010-3 2 | FI | | | | |
| 13 Electrical Motors | *Sec 16150-1 1 1 2 NEMA Standard | FI | | | | |
| 14 General Electric | RFP Std SE-103 SE-104, SE-112, SE-114, and SC-107 *Sec 16050-1.1, 2.3 3 6 NEC UL Listed | FI | | | | |
| 15 Electrical Panel Boards | *Sec 16160 NEC III. Listed | FI | | | | |
| 16 Electrical Grounding | *Sec 16450-1.2 NEC, IEEE 142, UL Listed | FI | | | | |
| 17 Instrumentation | *Sec 17050 | FI | | | | |
| 18 Leak Detection | *Sec 17220 | FI | | | | |
| 19 Collection Gallery | *Sec 02554, ASTM D-1593, D792, D 882, D 3083, D 1004, D 1239, D 3083, D 1203, D 4632, D 4833, D 3786, D 4533, D 4751, D 4491, D 4355 | FI | | | | |

SECTION 5
COMPONENT CHECKOUT AND SYSTEMS
OPERATIONS TEST PROCEDURES

**COMPONENT CHECKOUT
PHASE IIB
881 HILLSIDE REMEDIAL ACTION**

| COMPONENT | CHECKOUT SATISFACTORILY | | CHECKERS INITIALS | DATE |
|-----------------------|----------------------------|----|----------------------|------|
| | YES | NO | | |
| <u>Meter</u> | | | | |
| FE101 Sump Flow Meter | | | | |
| <u>Pumps</u> | | | | |
| P100 Collection Well | | | | |
| P101 Sump Pump | | | | |
| P102 Sump Pump | | | | |
| P103 Sump Pump | | | | |
| P104 Sump Pump | | | | |
| <u>Valves</u> | | | | |
| HV100A Ball Valve | | | | |
| HV100B Ball Valve | | | | |
| HV101A Ball Valve | | | | |
| HV101B Ball Valve | | | | |
| HV101C Ball Valve | | | | |
| HV102A Ball Valve | | | | |
| HV102B Ball Valve | | | | |
| HV103A Ball Valve | | | | |
| HV103B Ball Valve | | | | |
| HV104A Ball Valve | | | | |
| HV104B Ball Valve | | | | |

COMPONENT CHECKOUT

GENERIC PROCEDURES

HOW TO TEST

WHAT TO LOOK FOR

MOTORS

- * Bump motor by turning power on to the motor and then quickly turning off

- * Ensure that shaft is rotating in proper direction and that couplings (if any) are properly connected

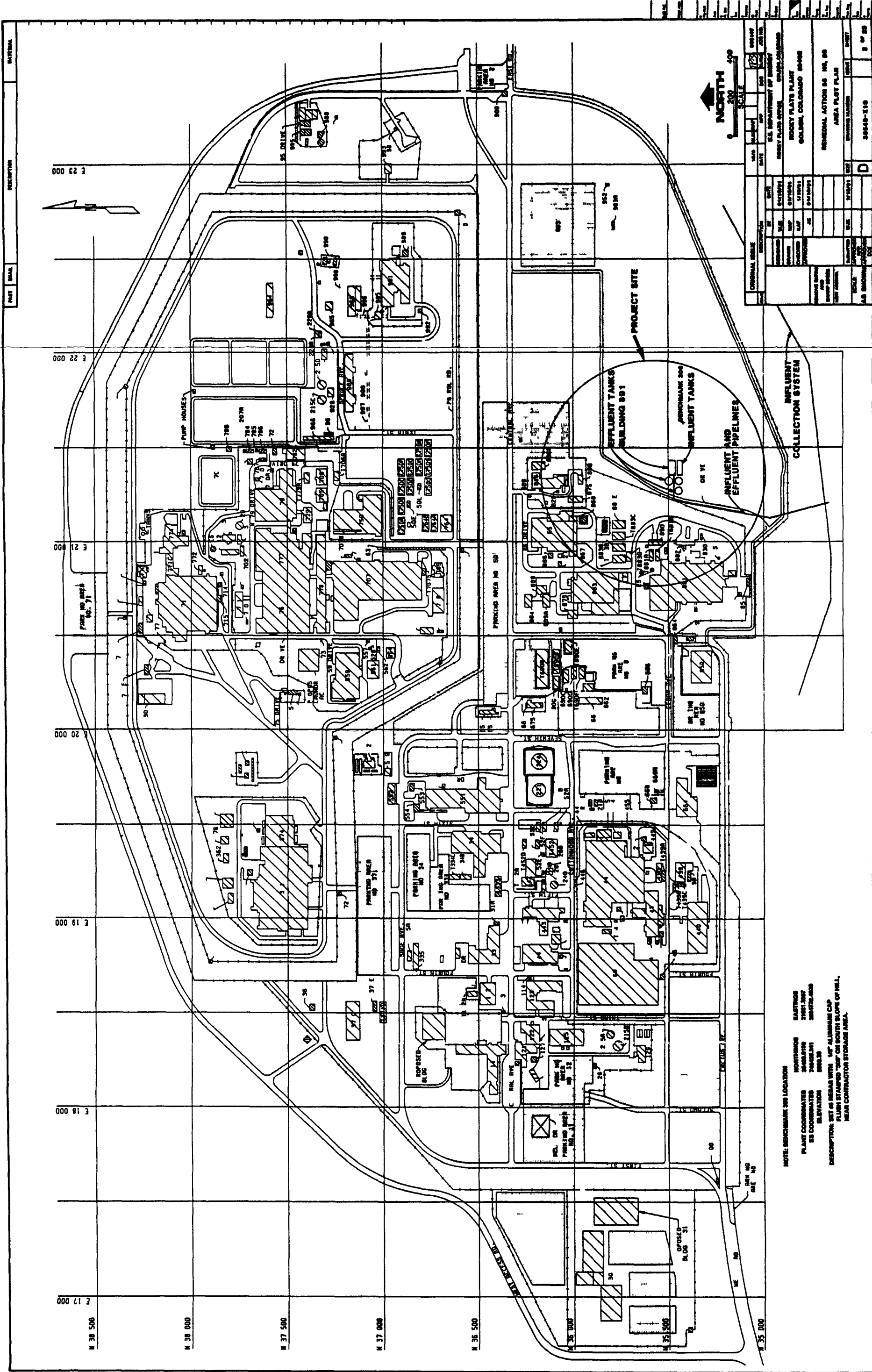
SYSTEMS OPERATIONAL TEST PROCEDURES
BUILDING 881 HILLSIDE REMEDIAL ACTION
PHASE IIB CONSTRUCTION

The Systems Operational Test Procedures for facilities included in Phase IIB Construction were previously released in Phase IIA and are included in the Construction Management Package for Phase IIA. This was necessary to insure that the entire treatment system was tested and functional according to a comprehensive SO test.

SECTION 6
COST ESTIMATE

SECTION 6
COST ESTIMATE

A cost estimate for the Phase IIB Construction facilities shall be prepared under separate cover

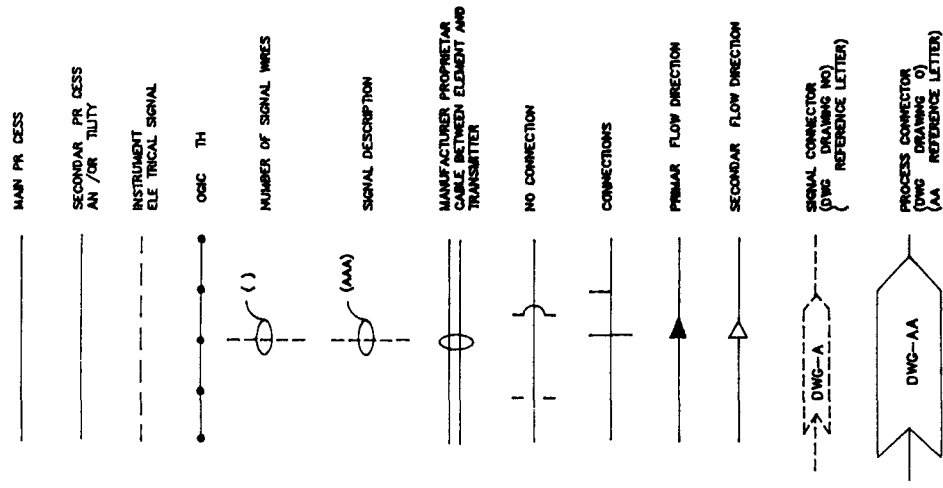


NOTE: BENCHMARK 300 LOCATION
EASTING 3181.300
NORTHING 3648.100
PLANT COORDINATES
EASTING 3181.300
NORTHING 3648.100
ELEVATION 888.30
DESCRIPTION: SET AS BENCHMARK WITH 1/4" ALUMINUM CAP
FLUSH STAMPED "300" ON SOUTH SLOPE OF HILL,
NEAR CONTRACTOR STORAGE AREA.

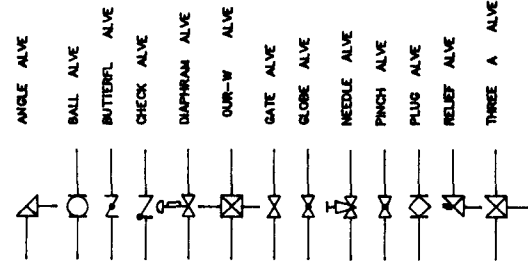
| GENERAL NOTE | | DATE | BY | REVISION |
|---|--|------|----|----------|
| 1. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SPECIFIED. | | | | |
| 2. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE U.S. DEPARTMENT OF ENERGY REGULATIONS. | | | | |
| 3. ALL MATERIALS SHALL BE OF THE BEST QUALITY AVAILABLE. | | | | |
| 4. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME. | | | | |
| 5. ALL UTILITIES SHALL BE PROTECTED AND MAINTAINED. | | | | |
| 6. ALL EROSION CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED. | | | | |
| 7. ALL SAFETY MEASURES SHALL BE STRICTLY ENFORCED. | | | | |
| 8. ALL RECORDS SHALL BE MAINTAINED AND UP-TO-DATE. | | | | |
| 9. ALL CHANGES SHALL BE APPROVED BY THE PROJECT MANAGER. | | | | |
| 10. ALL WORK SHALL BE COMPLETED WITHIN THE SPECIFIED TIME FRAME. | | | | |

| | |
|-----------------|---------------------------|
| PROJECT NO. | 30440-110 |
| DATE | 01/15/91 |
| BY | W. J. BROWN |
| REVISION | 1 |
| PROJECT NAME | ROCKY PLATE PLANT |
| LOCATION | GOLDEN, COLORADO 80400 |
| CLIENT | REMEDIAL ACTION 90 NO. 00 |
| AREA | AREA 101 PLANT |
| SCALE | AS SHOWN |
| PROJECT MANAGER | W. J. BROWN |
| DESIGNER | W. J. BROWN |
| CHECKER | W. J. BROWN |
| APPROVER | W. J. BROWN |

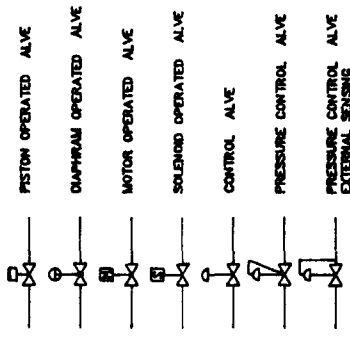
LINE SYMBOLS



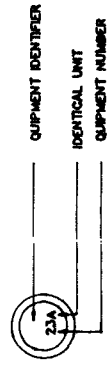
VALVE SYMBOLS



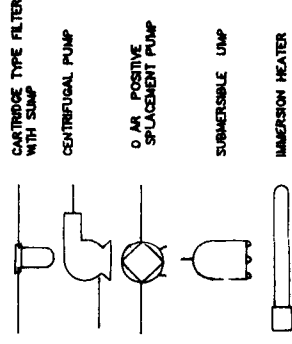
VALVE OPERATORS



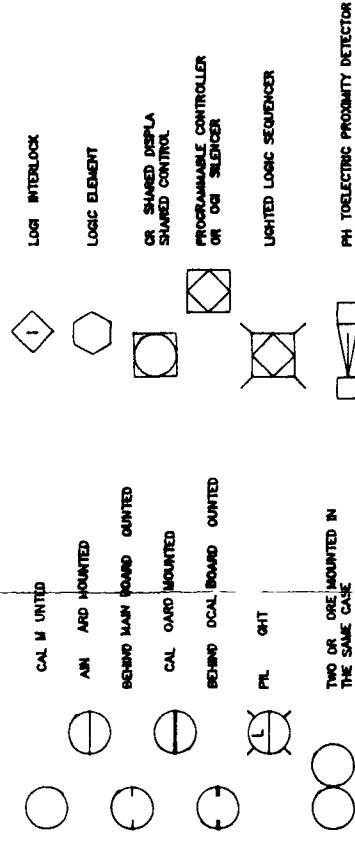
EQUIPMENT IDENTIFICATION



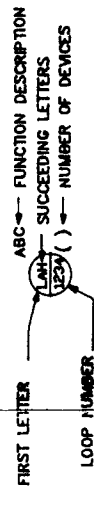
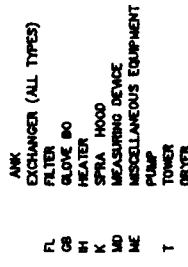
EQUIPMENT SYMBOLS



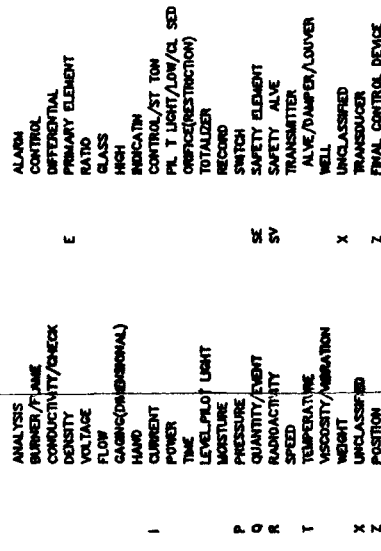
INSTRUMENT SYMBOLS



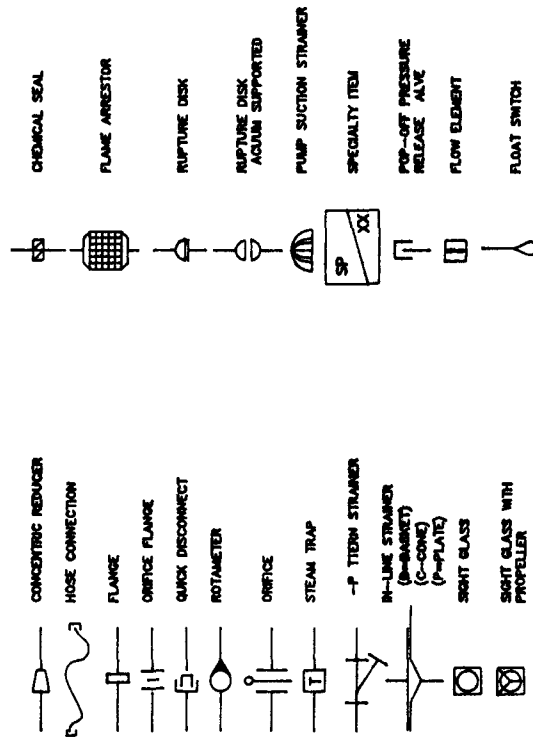
INSTRUMENT IDENTIFICATION

EQUIPMENT IDENTIFIER

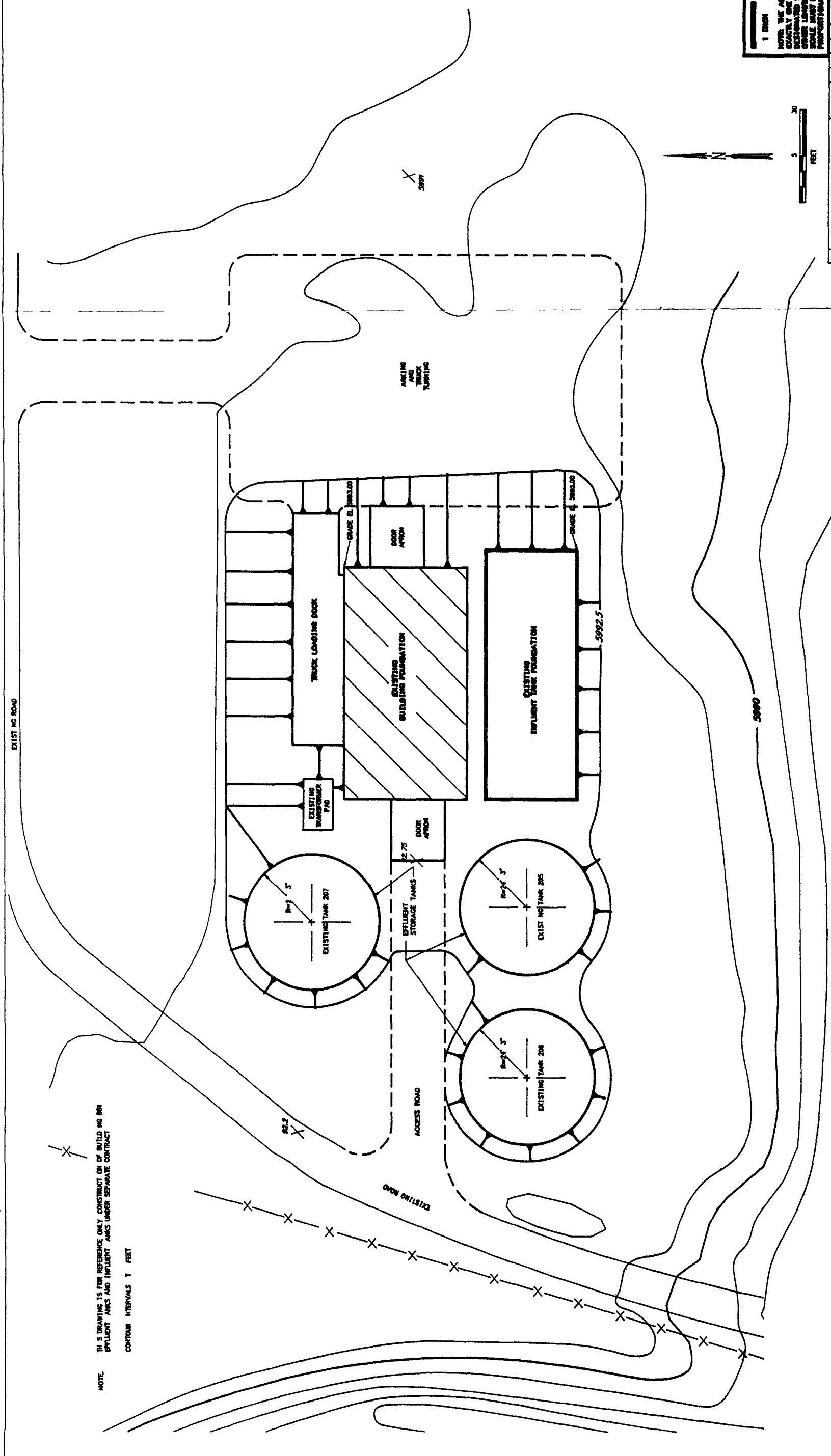
FIRST LETTER SUCCEEDING LETTERS



MISCELLANEOUS SYMBOLS

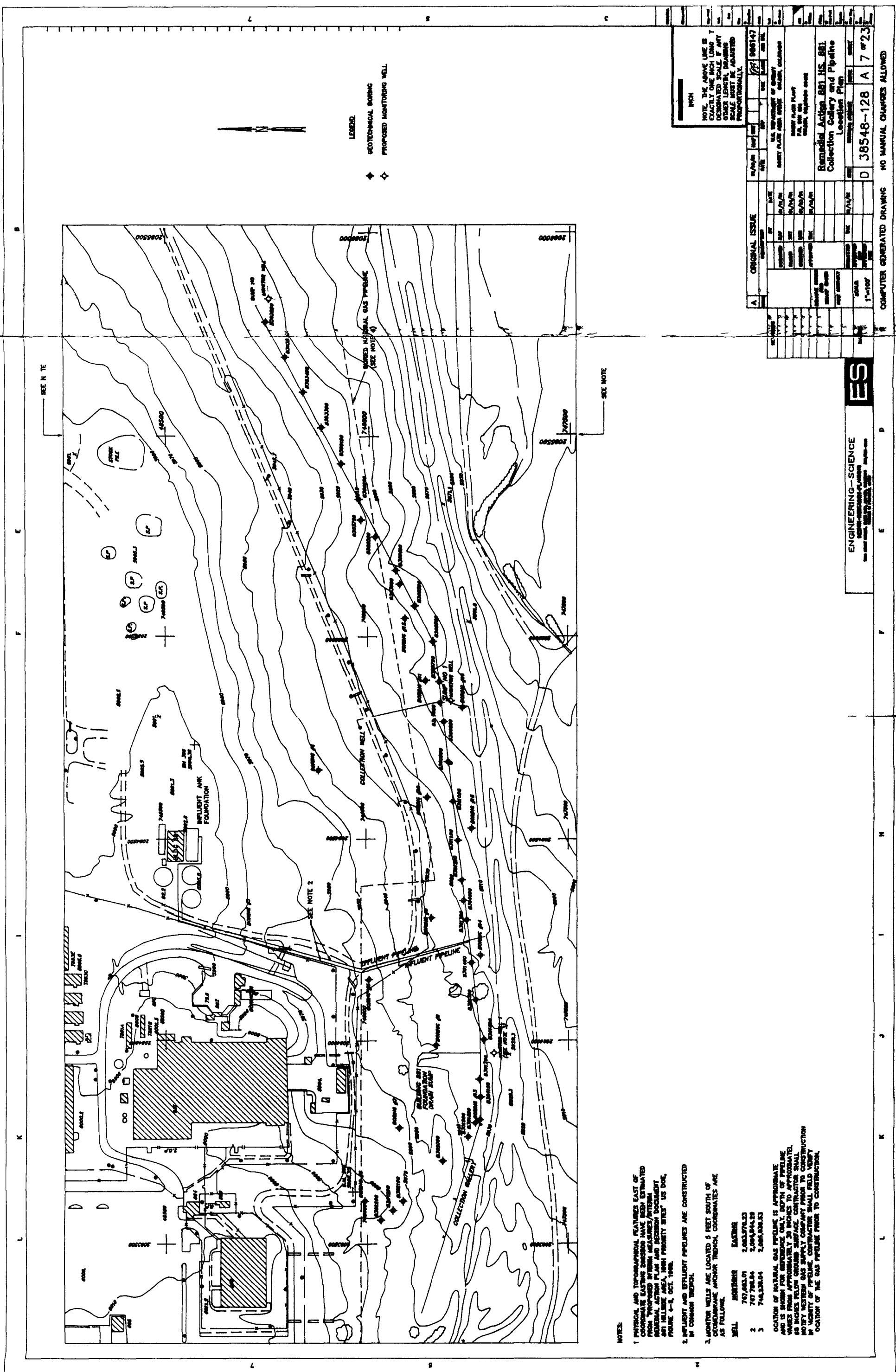


NOTE: THIS DRAWING IS FOR REFERENCE ONLY. CONSTRUCTION OF BUILDING NO. 881 EFFLUENT TANKS AND INFLUENT TANKS UNDER SEPARATE CONTRACT. CONTOUR INTERVALS 1 FEET.



1 INCH
NOTE: THE ABOVE LINE IS EXACTLY ONE INCH LONG. DESIGNATED SCALE. IF ANY OTHER LINE, MEASUREMENT SCALE MUST BE ASSIGNED PROPORTIONALLY.

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| DESIGNED BY | | | | DATE | | | | DATE | | | | DATE | | | | | | | |
| CHECKED BY | | | | DATE | | | | DATE | | | | DATE | | | | | | | |
| APPROVED BY | | | | DATE | | | | DATE | | | | DATE | | | | | | | |
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| SHEET TOTAL | | | | DATE | | | | DATE | | | | DATE | | | | | | | |
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NOTES:

1. PHYSICAL AND TOPOGRAPHICAL FEATURES EAST OF COORDINATE EASTING 280000 HAVE BEEN ESTIMATED FROM PROPOSED TRIMMED MEASUREMENTS. THESE MEASUREMENTS WERE OBTAINED FROM AERIAL PHOTOGRAPHS AND FIELD SURVEY DATA. THESE MEASUREMENTS WERE OBTAINED FROM AERIAL PHOTOGRAPHS AND FIELD SURVEY DATA. THESE MEASUREMENTS WERE OBTAINED FROM AERIAL PHOTOGRAPHS AND FIELD SURVEY DATA.
 2. INFLUENT AND EFFLUENT PIPELINES ARE CONSTRUCTED IN COMMON TRENCH.
 3. MONITOR WELLS ARE LOCATED 5 FEET SOUTH OF COORDINATE ANCHOR TRENCH. COORDINATES ARE AS FOLLOWS:

| WELL | NORTHING | EASTING |
|------|------------|--------------|
| 1 | 747,483.01 | 2,063,976.23 |
| 2 | 747,782.84 | 2,064,344.19 |
| 3 | 748,338.04 | 2,064,808.33 |
- LOCATION OF MATERIAL GAS PIPELINE IS APPROXIMATE AND IS SHOWN FOR REFERENCE ONLY. DEPTH OF PIPELINE Varies FROM APPROXIMATELY 20 FEET TO APPROXIMATELY 30 FEET. CONTRACTOR SHALL VERIFY LOCATION OF PIPELINE PRIOR TO CONSTRUCTION. CONTRACTOR SHALL VERIFY LOCATION OF THE GAS PIPELINE PRIOR TO CONSTRUCTION.

NOTE: THE ABOVE LINE IS EXACTLY ONE INCH LONG. IT IS NOT TO BE USED FOR ANY OTHER LENGTH. THE SCALE MUST BE ADJUSTED PROPORTIONALLY.

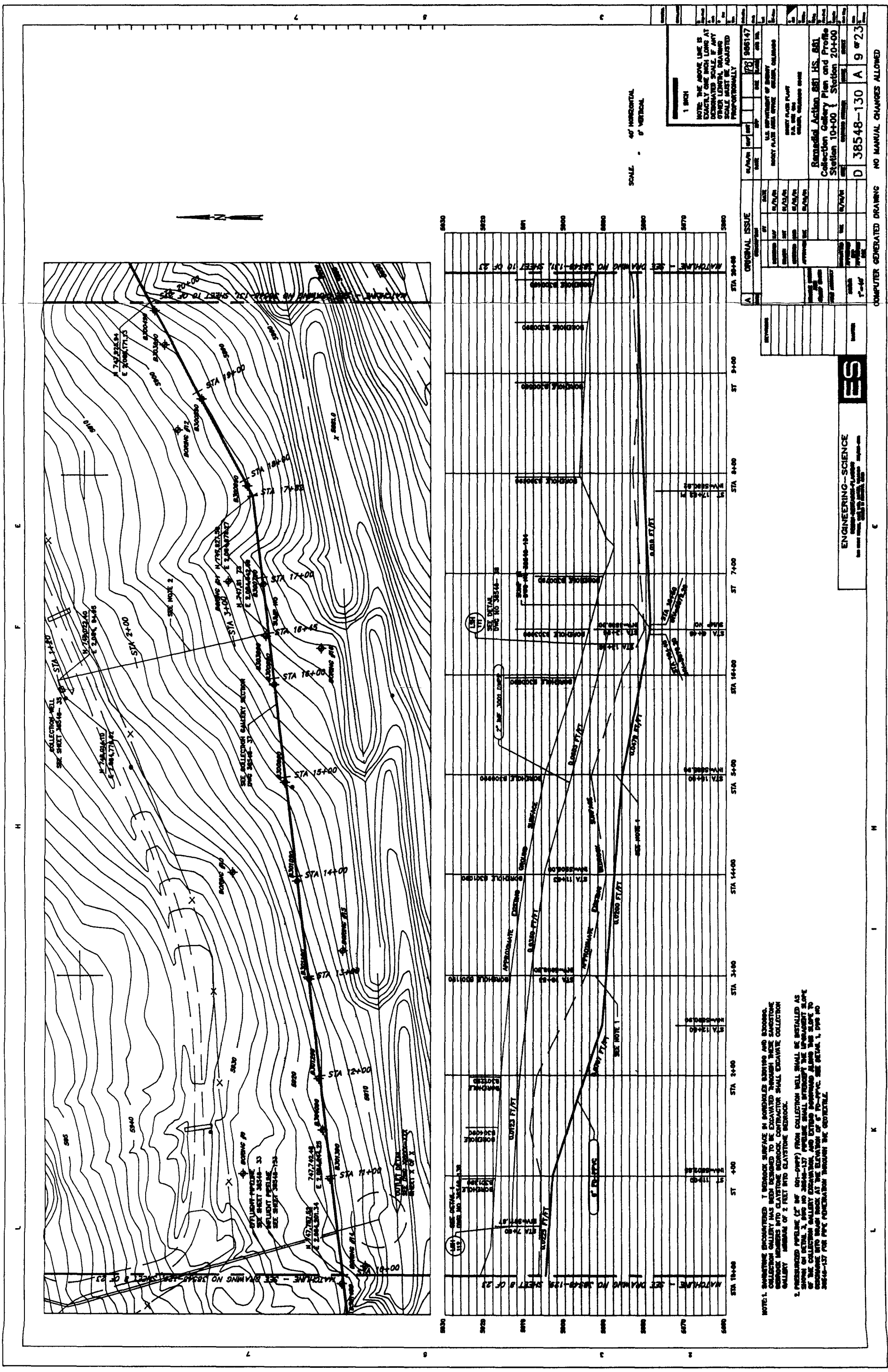
| ORIGINAL ISSUE | | | | REVISIONS | | | |
|----------------|---------|-----|-------------|-----------|---------|-----|-------------|
| NO. | DATE | BY | DESCRIPTION | NO. | DATE | BY | DESCRIPTION |
| 1 | 10/1/77 | ... | ... | 2 | 10/1/77 | ... | ... |
| 3 | 10/1/77 | ... | ... | 4 | 10/1/77 | ... | ... |
| 5 | 10/1/77 | ... | ... | 6 | 10/1/77 | ... | ... |
| 7 | 10/1/77 | ... | ... | 8 | 10/1/77 | ... | ... |
| 9 | 10/1/77 | ... | ... | 10 | 10/1/77 | ... | ... |
| 11 | 10/1/77 | ... | ... | 12 | 10/1/77 | ... | ... |
| 13 | 10/1/77 | ... | ... | 14 | 10/1/77 | ... | ... |
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| 17 | 10/1/77 | ... | ... | 18 | 10/1/77 | ... | ... |
| 19 | 10/1/77 | ... | ... | 20 | 10/1/77 | ... | ... |
| 21 | 10/1/77 | ... | ... | 22 | 10/1/77 | ... | ... |
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ENGINEERING—SCIENCE

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NO. 38548-128 A 7 OF 23

COMPUTER GENERATED DRAWING NO MANUAL CHANGES ALLOWED

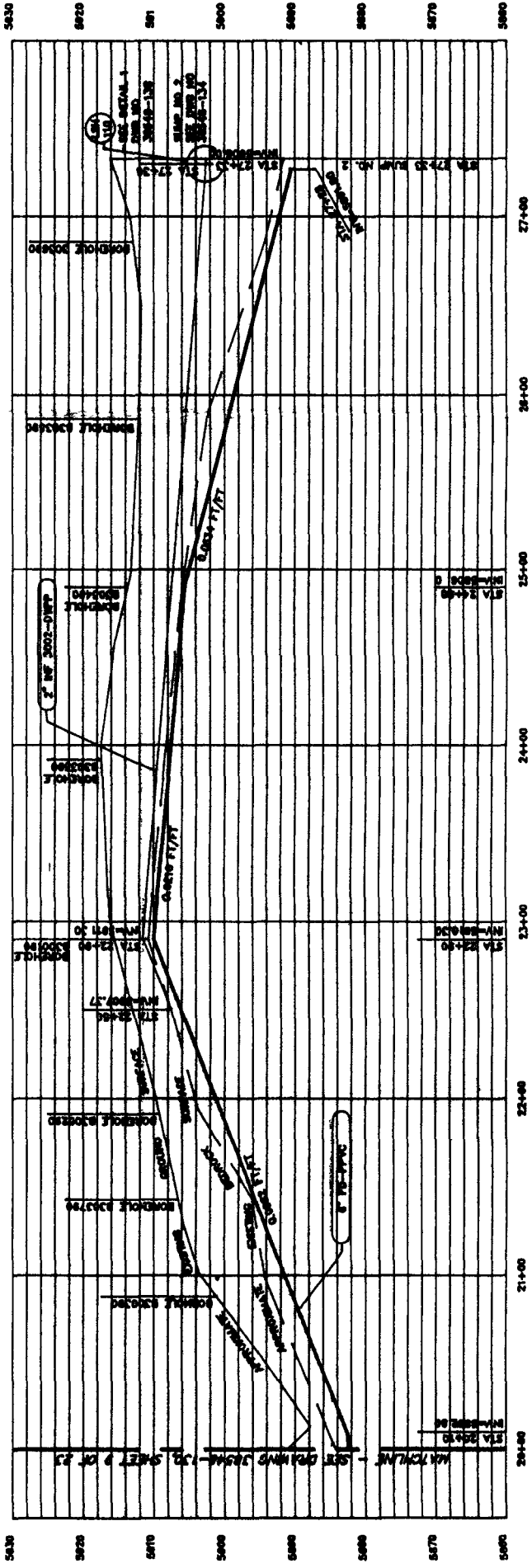
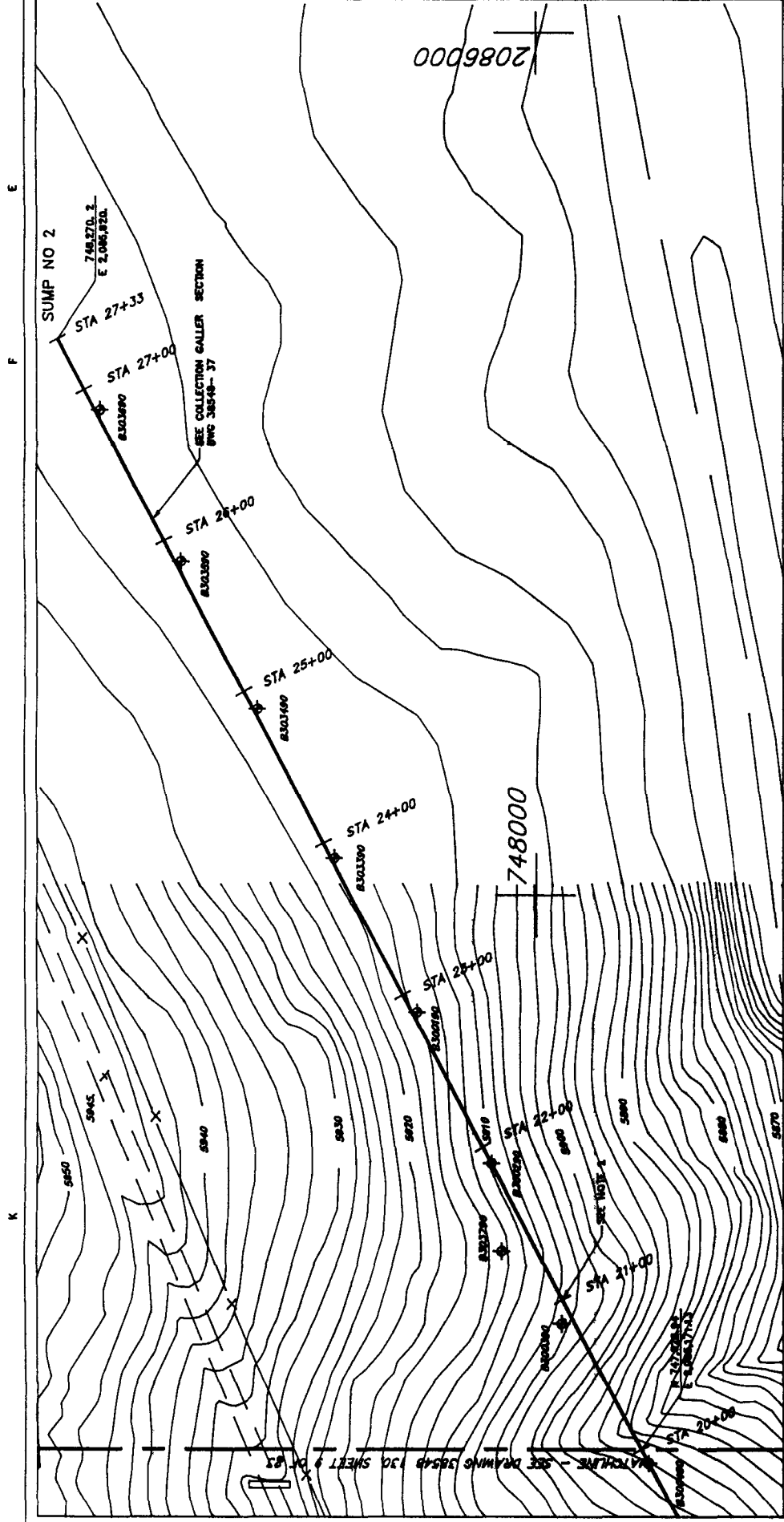


NOTE: 1. SANDSTONE ENCOUNTERED IN BEDROCK SURFACE IN BOREHOLES 820190 AND 820080. COLLECTION GALLERY HAS BEEN DESIGNED TO BE EXCAVATED THROUGH THESE SANDSTONE BOREHOLE MEMBERS INTO CLAYSTONE BEDROCK. CONTRACTOR SHALL EXCAVATE COLLECTION GALLERY MEMBERS OF 2 FEET INTO CLAYSTONE BEDROCK.

2. PRESSURIZED PIPELINE (2" ID 901-0007) FROM COLLECTION WELL SHALL BE INSTALLED AS SHOWN ON DETAIL 1, AND NO 20044-137 PIPELINE SHALL INTERCEPT THE UPWARD SLOPE OF THE COLLECTION GALLERY EXCAVATION, AND EXTEND DOWNWARD ALONG THE SLOPE TO EXCAVATE INTO SANDY BED AT THE ELEVATION OF 5' PD-PPVC. SEE DETAIL 1, DWS NO 20044-137 FOR PPE PUNCTURATION THROUGH THE GROUNDLINE.

1 INCH
NOTE: THE ABOVE LINE IS EXACTLY ONE INCH LONG AT THE SCALE OF 1\"/>

| ORIGINAL ISSUE | | DATE | BY | REVISION |
|----------------|--|----------|----|----------|
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| B | | 05/25/00 | WJ | 2 |
| C | | 05/25/00 | WJ | 3 |
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| H | | 05/25/00 | WJ | 8 |
| I | | 05/25/00 | WJ | 9 |
| J | | 05/25/00 | WJ | 10 |
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| M | | 05/25/00 | WJ | 13 |
| N | | 05/25/00 | WJ | 14 |
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| U | | 05/25/00 | WJ | 21 |
| V | | 05/25/00 | WJ | 22 |
| W | | 05/25/00 | WJ | 23 |
| X | | 05/25/00 | WJ | 24 |
| Y | | 05/25/00 | WJ | 25 |
| Z | | 05/25/00 | WJ | 26 |
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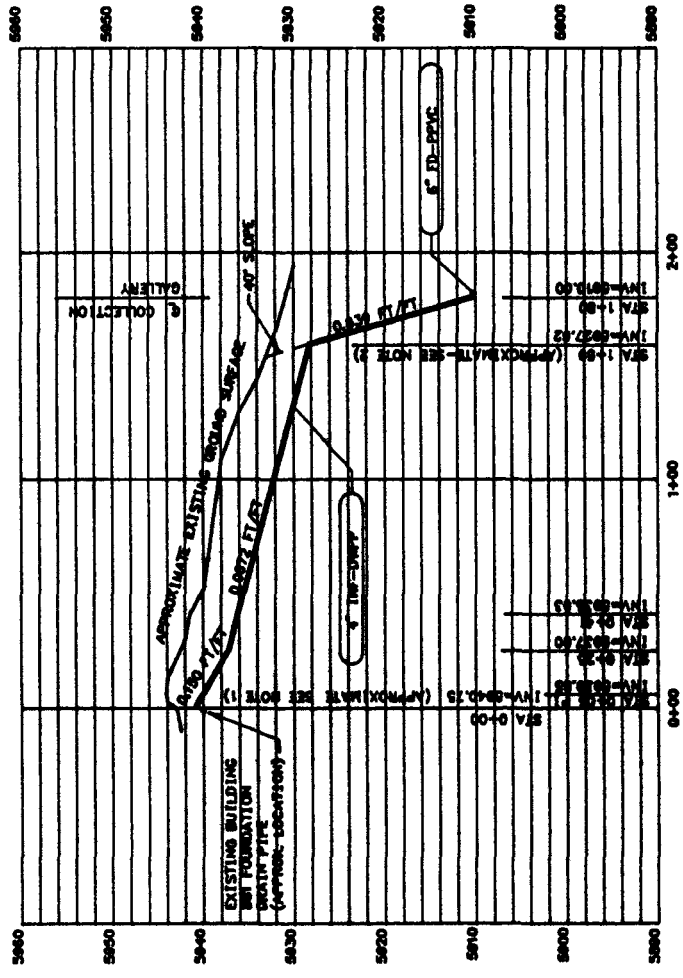
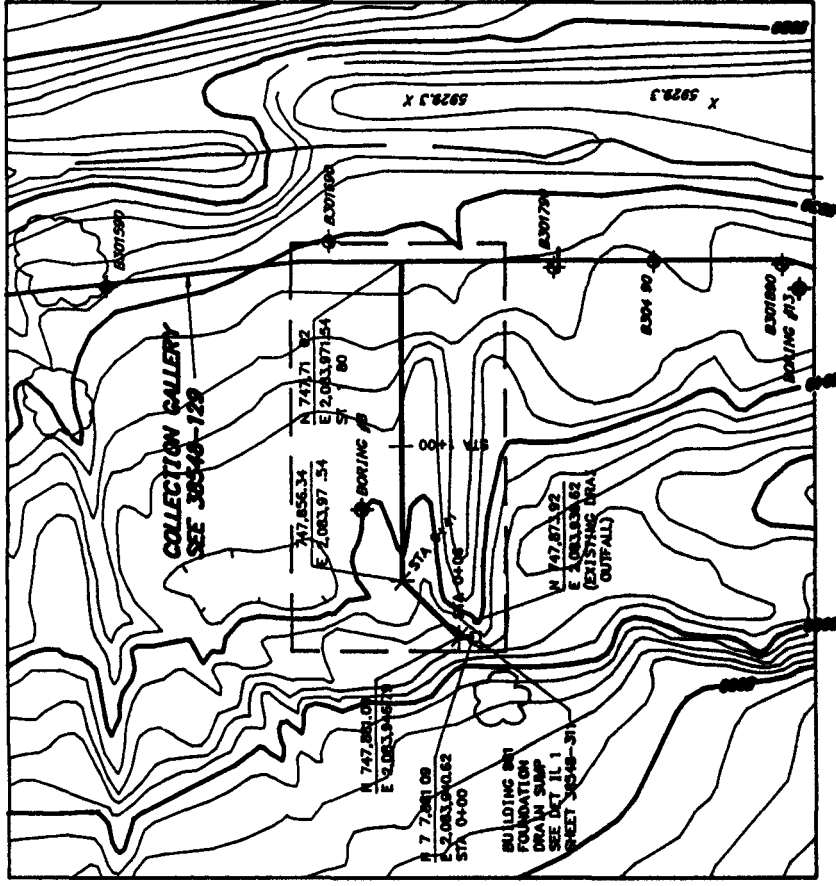
1. PHYSICAL AND TOPOGRAPHICAL FEATURES EAST OF COORDINATE EASTING 748000 HAVE BEEN ESTIMATED FROM PROPOSED INTERIOR MEASUREMENTS / INTERIOR REMEDIAL ACTION PLAN AND RECORDING DOCUMENT. REMEDIAL ACTION PLAN, INTERIOR MEASUREMENTS, AND RECORDING DOCUMENT ARE LOCATED AT: 1001 PRIORITY SITE'S US DOE PRIME 4-4, OCT 1988.
2. SEE DETAIL 2, SHEET 38548-137 FOR NATURAL GAS PIPELINE PENETRATION THROUGH GEOMEMBRANE IN THIS VICINITY.

NOTE: THE ABOVE LINE IS EXACTLY ONE INCH LONG. IF DENOTED SCALE IF ANY OTHER LENGTH, DRAWING SCALE MUST BE ADJUSTED PROPORTIONALLY.

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| 84 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 85 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 86 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 87 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 88 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 89 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 90 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 91 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 92 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 93 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 94 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 95 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 96 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 97 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 98 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 99 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |
| 100 | REVISED | 10/1/88 | WJH | | 10/1/88 | WJH | |

ENGINEERING-SCIENCE
1001 PRIORITY SITE'S US DOE PRIME 4-4, OCT 1988

NO MANUAL CHANGES ALLOWED



NOTES:

1. INVERT ELEVATION FOR 4" INF DWWP T. THE BUILDING BSI FOUNDATION DRAIN SUMP SHALL BE FIELD LOCATED BY THE CONTRACTOR (SEE DRAWING 38548-371, DETAIL 1).
2. LOCATION AND INVERT ELEVATION FOR 4" INF-DWWP SHALL BE FIELD LOCATED BY THE CONTRACTOR TO INTERSECT THE IDENTIFICATION LINES AND EXTENDING TO THE BUILDING BSI FOUNDATION DRAIN SUMP. THE ELEVATION OF THE DRAIN SUMP SHALL BE SLOTTED TO OUTFALL T. THE ELEVATION OF 4" PP-PPVC SEE DETAIL 1, DRAWING 38548-37 FOR GEOTEXTILE PENETRATION.

SCALE = 40' HORIZONTAL
1" = 0' VERTICAL

NOTE 1

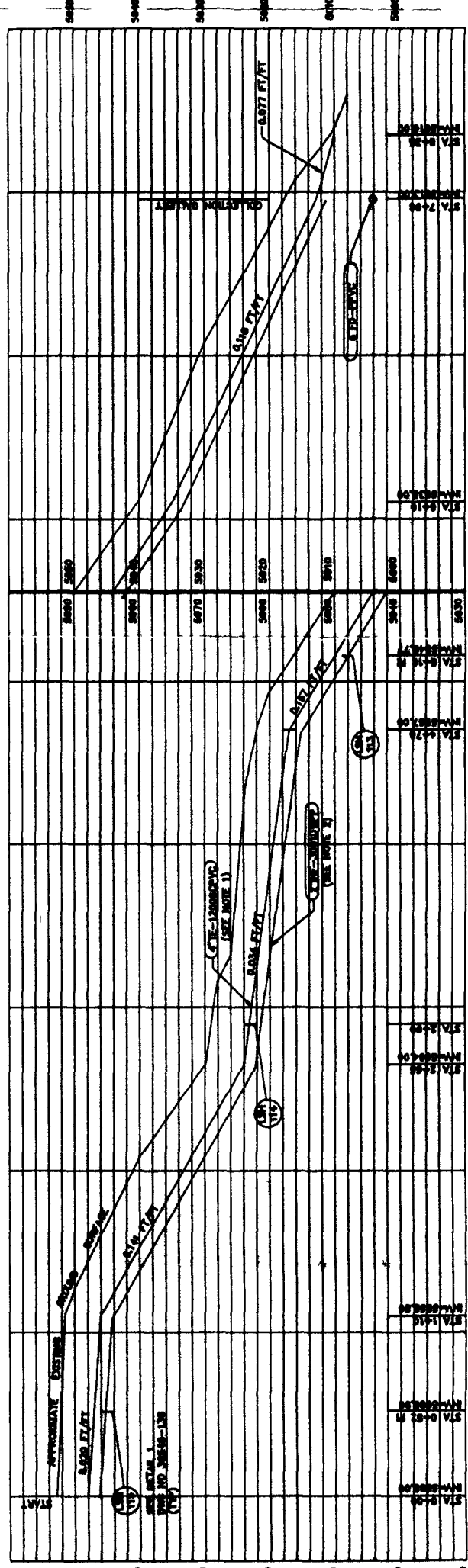
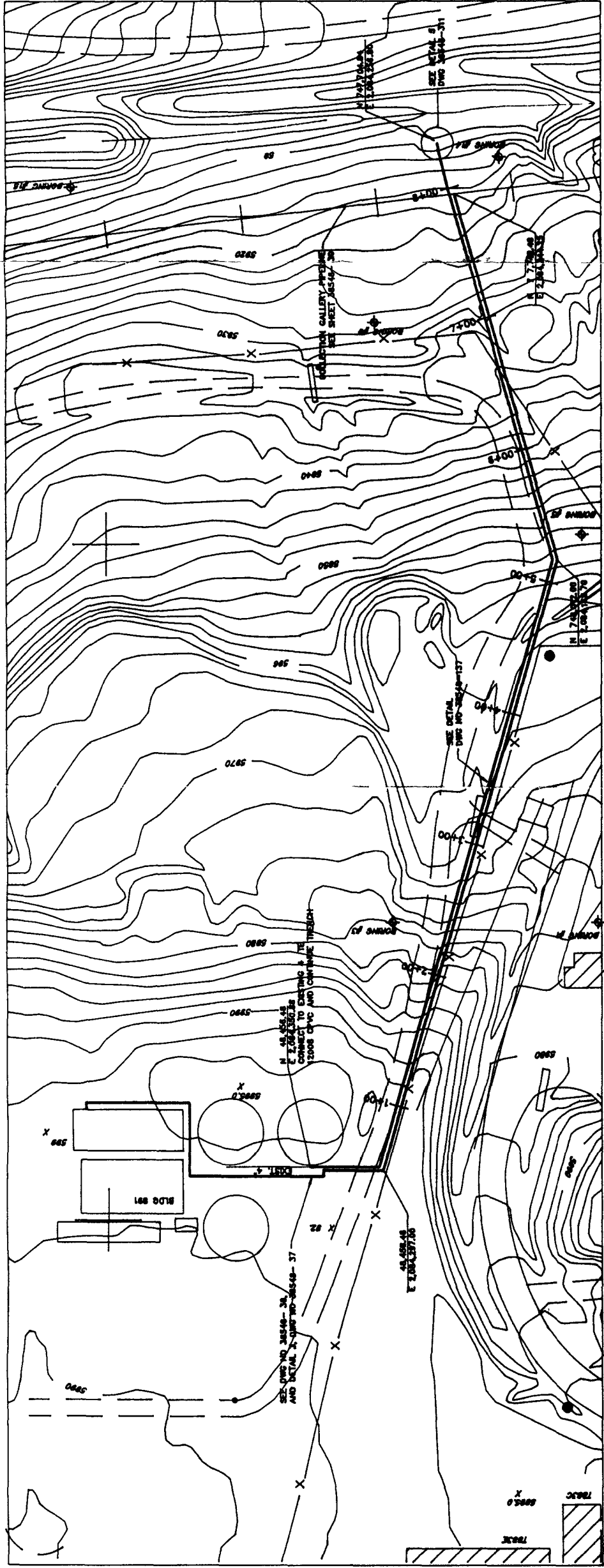
NOTE: THE ABOVE LINE IS EXACTLY ONE INCH LONG AT DESIGNATED SCALE. IF ANY OTHER LENGTH, DRAWING SCALE MUST BE ADJUSTED PROPORTIONALLY.

[illegible]

ENGINEERING—SCIENCE

OSW

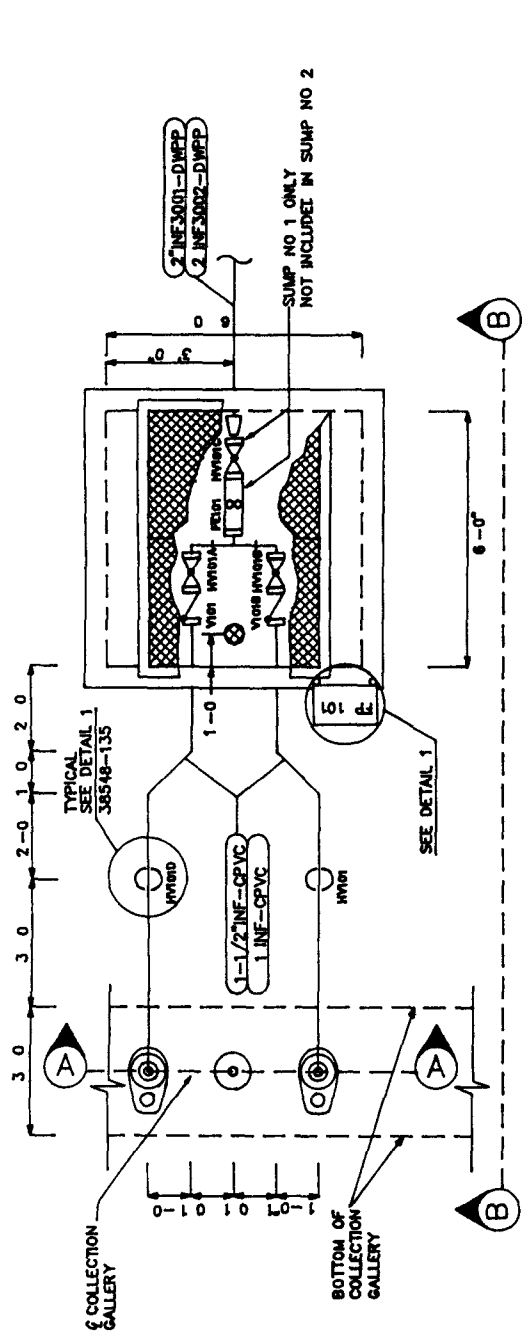
COMPUTER GENERATED DRAWING NO MANUAL CHANGES ALLOWED



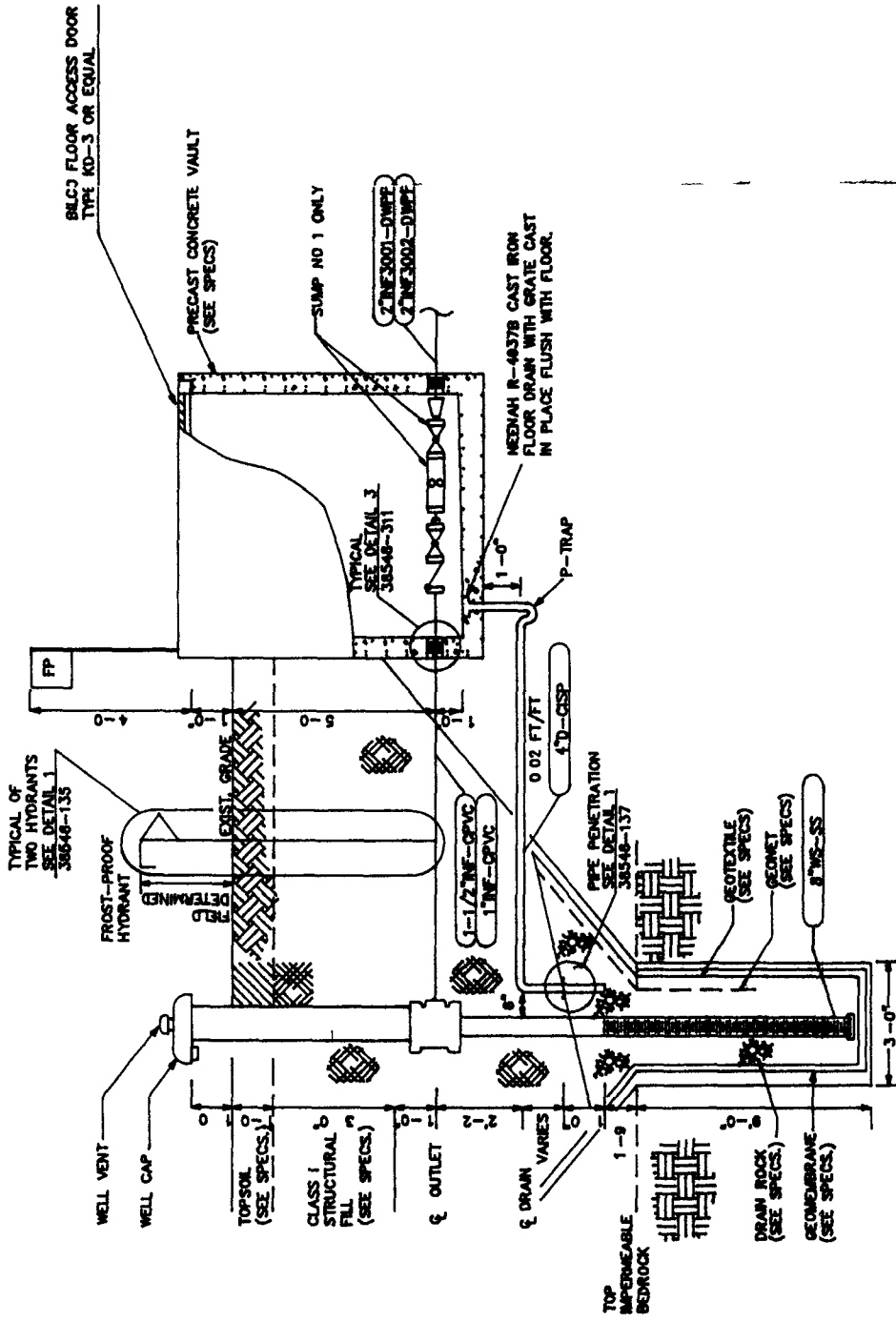
NOTES:
 INVERT ELEVATIONS SHOWN ON PROFILE ARE FOR THE
 3000-CVPC EFFLUENT PIPELINE.
 2. THE INVERT FOR THE 3" 3000-DWPP EFFLUENT
 PIPELINE IS LOCATED .33 FEET BELOW THE EFFLUENT
 PIPELINE INVERT, OFFSET 2 FEET IN THE SAME TRENCH
 (SEE DETAIL OF DRAINING 38548-37).

NOTE: THE ABOVE LINE IS
 EXACTLY ONE INCH LONG A
 DESIGNATED SCALE OF ANY
 OTHER LENGTH, INCHES
 SHALL BE SET AT ADJUSTED
 PROPORTIONALLY.

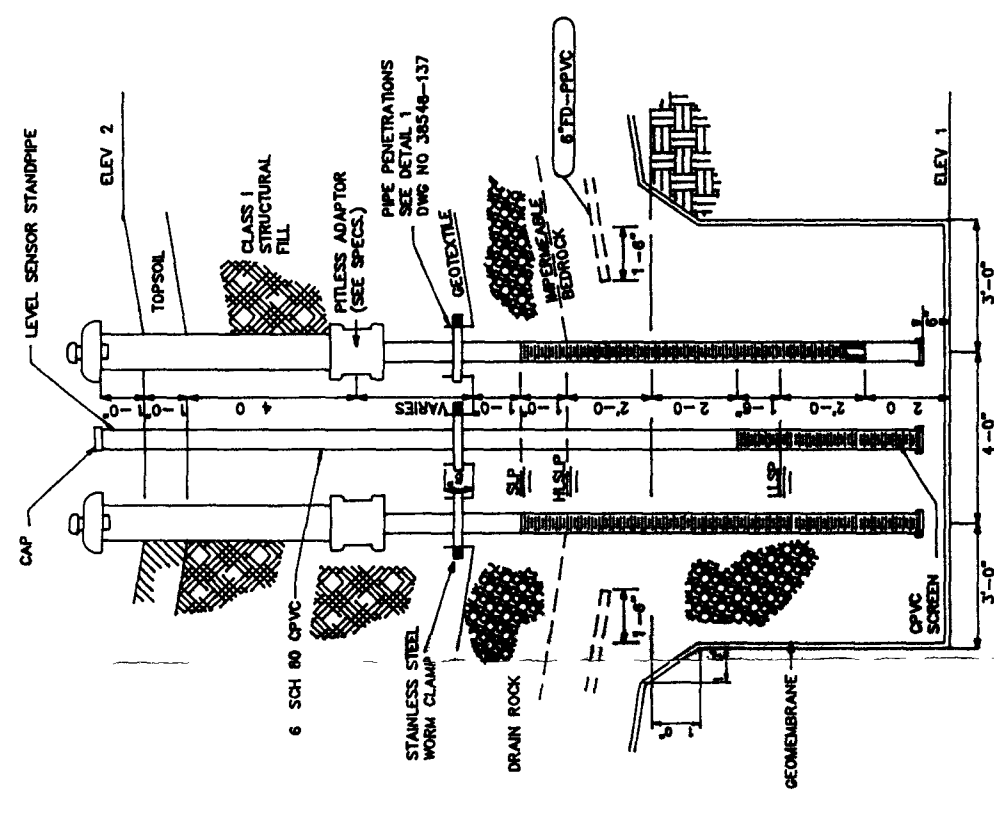
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| A | ORIGINAL ISSUE | | DATE | | BY | | REVISION | | DATE | | BY | | REVISION | |
| | ISSUED | REVISED | ISSUED | REVISED | ISSUED | REVISED | ISSUED | REVISED | ISSUED | REVISED | ISSUED | REVISED | ISSUED | REVISED |
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TYPICAL OF TWO SYSTEMS (SUMPS NO 1 AND 2)
COLLECTION GALLERY SUMP
AND METER/VALVE VAULT PLAN VIEW
38548-130, 131 NOT TO SCALE



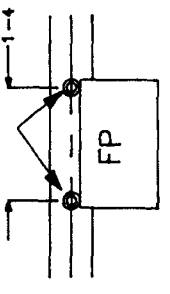
COLLECTION GALLERY SUMP
AND METER/VALVE VAULT SECTION B-B
38548-130, 131 NOT TO SCALE



| APPROXIMATE ELEVATION (USGS) | | | | | |
|------------------------------|------------|-------------|-------------|---------------|---------------|
| FRENCH DRAIN | SLP (FEET) | HLSP (FEET) | LLSP (FEET) | ELEV 1 (FEET) | ELEV 2 (FEET) |
| SUMP | | | | | |
| 1 | 5881.4 | 5880.4 | 5775.4 | 5771.4 | 5884.00 |
| 2 | 5890.00 | 5888.00 | 5884.00 | 5880.00 | 5916.00 |

COLLECTION SUMP
AND METER/VAULT SECTION A-A
38548-130, 131 NOT TO SCALE

1 1/2" GALVANIZED STEEL PIPES SET IN
2 1/2" DIAMETER, 8" DEEP HOLES IN THE
CONCRETE VAULT AND GROUTED OR
EPOXYED IN PLACE.



NOTE: SEE DRAWING 38548-724
FOR ELECTRICAL CONNECTIONS

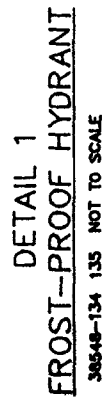
DETAIL 1
38548-134, 135 NOT TO SCALE

ENVIRONMENTAL SCIENCE
INCORPORATED
1000 WEST 10TH AVENUE
DENVER, CO 80202

ES

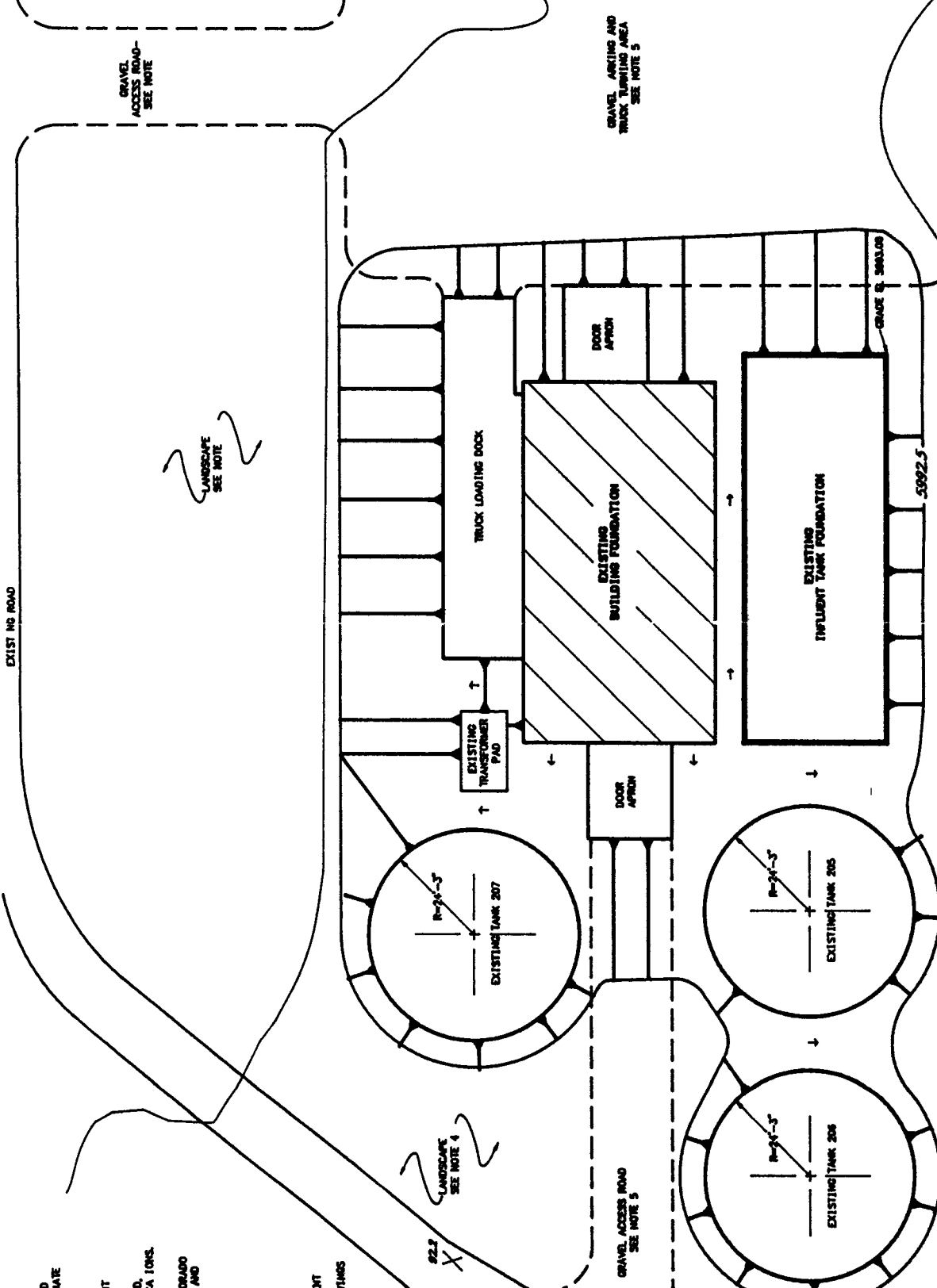
| REVISIONS | | DATE | BY | DESCRIPTION |
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| 2 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 3 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 4 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 5 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 6 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
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| 9 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
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| 11 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 12 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
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| 14 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 15 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 16 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 17 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 18 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 19 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
| 20 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
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| 24 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
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| 30 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
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| 32 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |
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| 100 | 08/01/97 | 08/01/97 | 08/01/97 | 08/01/97 |

Remedial Action 881 HS. B81
Collection Sump
Plan and Details
38548-134 A 13023
D 38548-134 A 13023
C COMPUTER GENERATED DRAWING NO MANUAL CHANGES ALLOWED



PROGRESSIVE SCIENCE
 15000 15000 PLACES
 IN OUR OWN STATE OF NEW YORK

- NOTES:
- CONTRACTOR SHALL SLOPE 901 AWA FROM ALL STRUCTURES AND FOUNDATIONS A 2:1 TO MEET EXISTING GRADE. APPROXIMATE TOE OF SLOPE 1:5002.5 SHOWN.
 - CONTOUR INTERVALS A 2 FEET.
 - CONSTRUCTION OF BUILDING AND INFLUENT TANKS AND INFLUENT TANKS ARE UNDER SEPARATE CONTRACT.
 - AFTER FINAL GRADING, ALL DISTURBED AREAS WILL BE PREPARED, FERTILIZED, SEEDING AND WATERED ACCORDING TO THE SPECIFICATIONS.
 - THE GRAVEL ACCESS ROADS AND TRUCK TURNING AREAS SHALL BE 2 INCH THICK GRAVEL ACCORDING TO THE COLORADO DIVISION OF HIGHWAYS, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, CLASS 6, CLASSIFIED AS FOLLOWS:
PERCENT BY WEIGHT: ASTING
SIEVE DESIGNATION: SQUARE MESH SIEVES
3/4 INCH: 00 65
NO. 4: 30 65
NO. 8: 25 55
NO. 20: 3 2
 - FINAL GRADING FOR COLLECTION GALLERY AND INFLUENT/REFUGENT PIPELINES. THE FINAL GRADES WILL BE RESTORED TO THEIR ORIGINAL CONTOURS BEFORE CONSTRUCTION AS SHOWN ON DRAWINGS 30548-20, 31, 32, AND 33.



1 INCH

NOTE: THE ABOVE LINE IS FOR THE PURPOSE OF A PROPORTIONAL SCALE OF 1" = 40'.

SCALE: 1" = 40'

PROPORTIONAL SCALE

| ORIGINAL ISSUE | | DATE | | BY | | DATE | | BY | |
|----------------|-------------------|---------|-----|------|-----|------|-----|------|-----|
| NO. | DESCRIPTION | DATE | BY | DATE | BY | DATE | BY | DATE | BY |
| 1 | ISSUED FOR PERMIT | 10/1/81 | ... | ... | ... | ... | ... | ... | ... |
| 2 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 3 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
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| 33 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
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| 35 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
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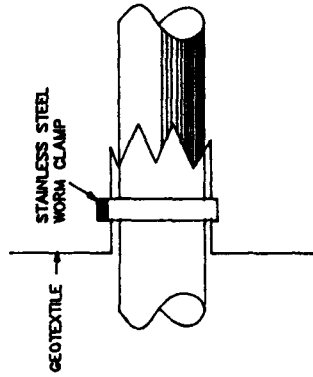
Remedial Action 881 US 881
Final Grading, Drainage
and Landscaping Plan

36548-136 A 15-23

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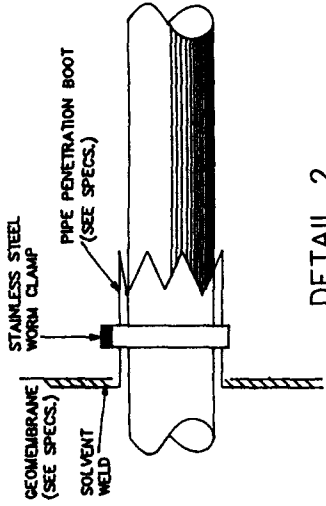
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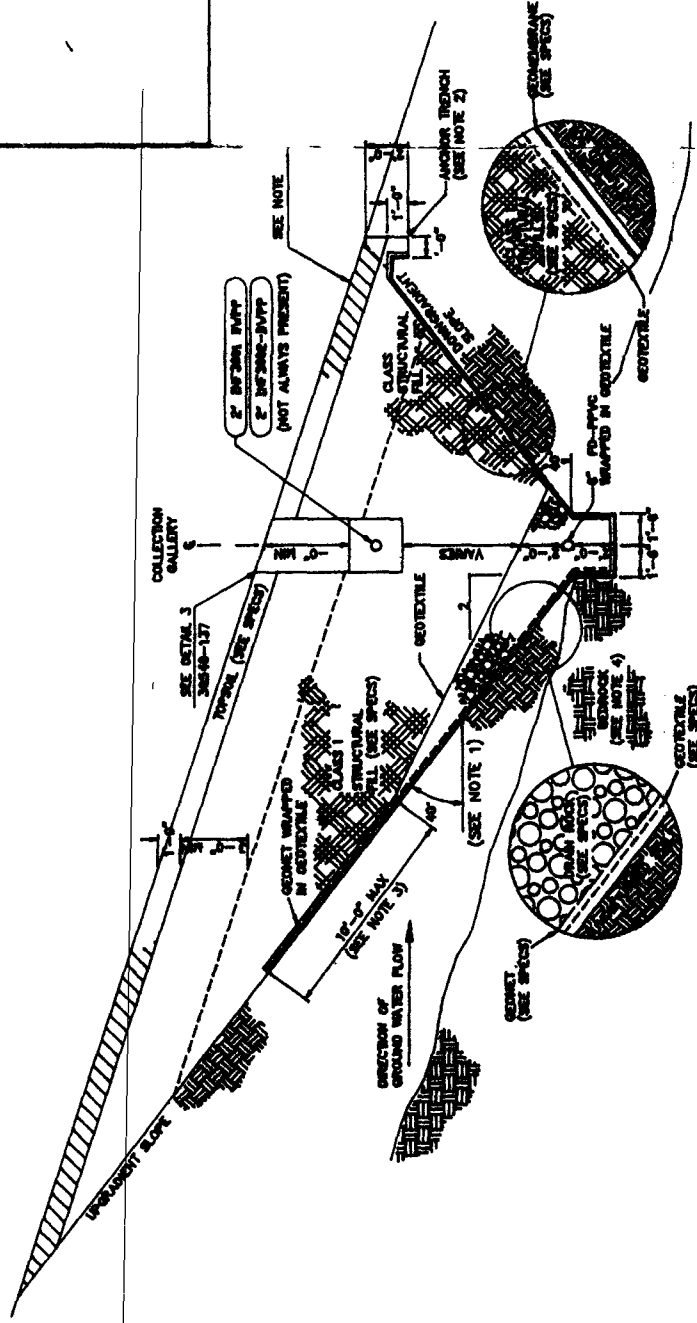
DETAIL 1
PIPE PENETRATION
IN GEOTEXTILE

38548-130, 132, 134 NOT TO SCALE



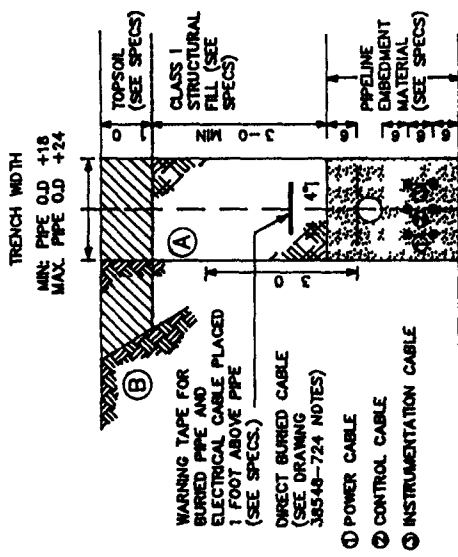
DETAIL 2
PIPE PENETRATION
IN GEOMEMBRANE

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TYPICAL COLLECTION GALLERY SECTION

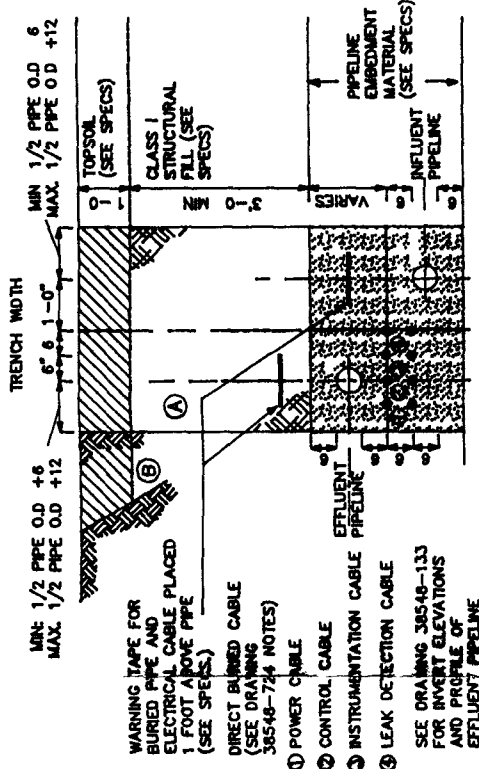
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DETAIL 3
TYPICAL PIPELINE SECTION

38548-130, 133, 137 724 NOT TO SCALE

- 1 ALTERNATE TRENCH SECTIONS (A AND B) ARE FOR USE ONLY WHERE STABLE, COMPACT SOIL CONDITIONS EXIST
- VERTICAL (A) TRENCH: FOR DEPTHS LESS THAN 5 FEET - SHORING MAY BE REQUIRED
- COMBINATION VERTICAL AND SLOPING (B) TRENCH: FOR DEPTHS EXCEEDING 5 FEET SHORING, SOLD SHEETING, OR A TRENCH BOX IS REQUIRED.
- DESIGN CALCULATIONS BY A DULY REGISTERED CIVIL ENGINEER IN THE STATE OF COLORADO AND APPROVAL BY BUYER OF SUPPORT METHODS ARE REQUIRED FOR ALL VERTICAL SIDEWALLS.
- 2 WHERE WET UNSTABLE, OR RUNNING SOIL IS ENCOUNTERED SOLD SHEETING IS REQUIRED FOR ALL VERTICAL SIDEWALLS.



DETAIL 4
TYPICAL COMBINATION INFLUENT
AND EFFLUENT TRENCH

38548-133, 724 NOT TO SCALE

- 1 ALTERNATE TRENCH SECTIONS (A AND B) ARE FOR USE ONLY WHERE STABLE, COMPACT SOIL CONDITIONS EXIST
- VERTICAL (A) TRENCH: FOR DEPTHS LESS THAN 5 FEET - SHORING MAY BE REQUIRED
- COMBINATION VERTICAL AND SLOPING (B) TRENCH: FOR DEPTHS EXCEEDING 5 FEET SHORING, SOLD SHEETING, OR A TRENCH BOX IS REQUIRED
- DESIGN CALCULATIONS BY A DULY REGISTERED CIVIL ENGINEER IN THE STATE OF COLORADO AND APPROVAL BY BUYER OF SUPPORT METHODS ARE REQUIRED FOR ALL VERTICAL SIDEWALLS.
- 2 WHERE WET UNSTABLE, OR RUNNING SOIL IS ENCOUNTERED SOLD SHEETING IS REQUIRED FOR ALL VERTICAL SIDEWALLS.
- 3 CONTRACTOR MAY LOWER EFFLUENT PIPELINE TO MATCH INFLUENT PIPELINE ELEVATION THIS OPTION WILL NOT CONSTITUTE A CHANGE IN CONTRACT PRICE

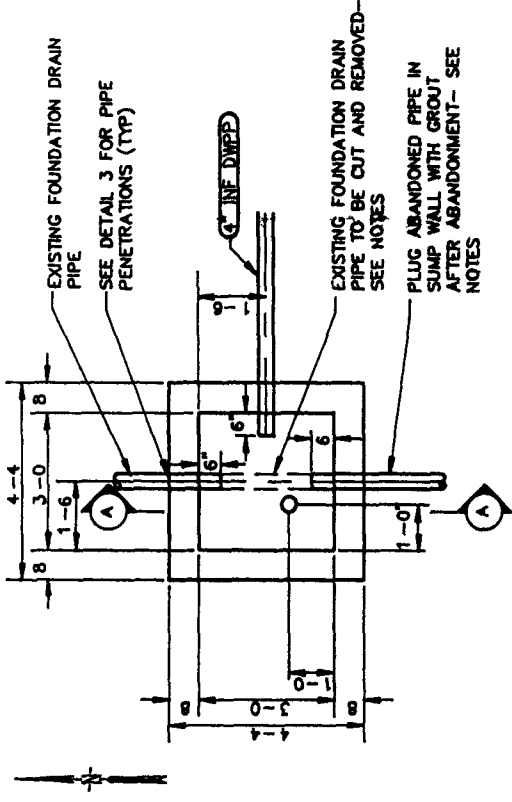
- NOTES
- THE CONTRACTOR SHALL CONSTRUCT THE COLLECTION GALLERY SO AS TO MINIMIZE THE AMOUNT OF EXCAVATION NECESSARY. EXCAVATION OF THE TRENCH, THE CONTRACTOR MAY INCREASE THE STRENGTH OF THE TRENCH WALLS, PROVIDED THAT CONSTRUCTION CAN PROCEED WITHOUT EXHAUSTING BORDERS.
- 2 ANCHOR TRENCH IS EXCAVATED TWO FEET BELOW THE LOCATION WHERE THE FOREWATER SLOPE INTERSECTS EXISTING SURFACE TOPOGRAPHY.
- 3 ACTUAL HEIGHT OF INSTALLED GEOMET WILL VARY. AT LEAST THREE FEET OF STRUCTURAL FILL AND ONE FOOT OF TOPSOIL SHALL BE PLACED ABOVE TOP OF GEOMET.
- 4 TOP OF IMPERMEABLE (CLAYSTONE) BEDROCK MAY BE HIGHER THAN SHOWN. FINISHED GRADE SHALL BE RESTORED TO PRE-CONSTRUCTION TOPOGRAPHY.

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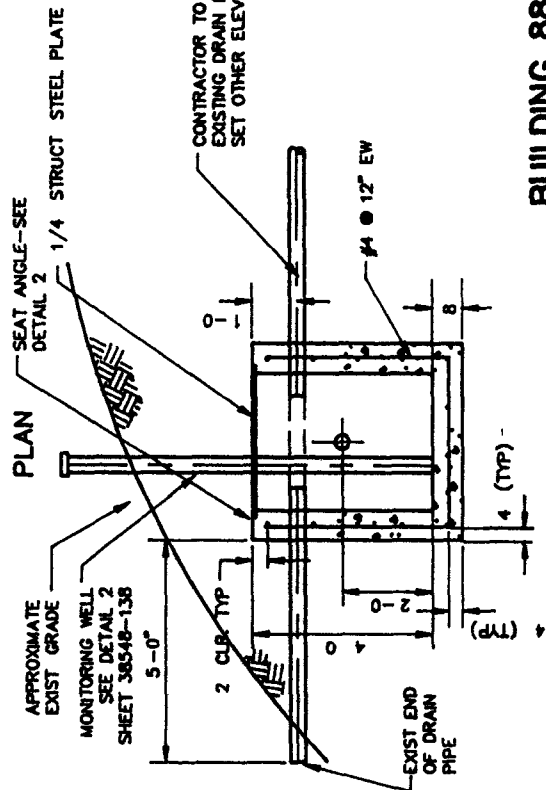
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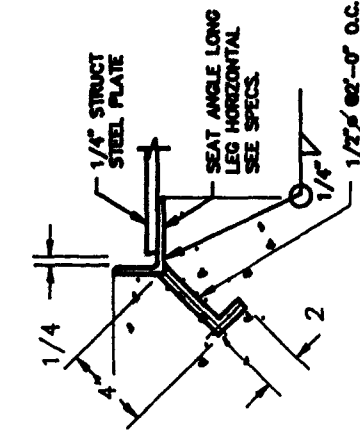
NOTES.

- 1 THE BUILDING 881 FOUNDATION DRAIN COLLECTION SUMP WILL BE LOCATED IN A SOLID WASTE MANAGEMENT UNIT THE CONTRACTOR WILL TAKE UTMOST CARE THAT THE HEALTH AND SAFETY OF HIS WORKERS ARE PROTECTED DURING CONSTRUCTION AND WILL CONFORM TO THE HEALTH AND SAFETY PLAN FOR THE PROJECT RECOMMENDED SEQUENCE OF CONSTRUCTION FOR THE SUMP IS PRESENTED IN NOTE 2.
- 2 RECOMMENDED SEQUENCE OF CONSTRUCTION
 - A) CONSTRUCT INFLUENT COLLECTION GALLERY SUMPS, AND DELIVERY SYSTEM
 - B) CONSTRUCT BUILDING 881 FOUNDATION DRAIN SUMP NORTH (UPSTREAM) OF EXISTING OUTFALL
 - C) CUT EXISTING DRAIN PIPE IN SUMP AS SHOWN AND REMOVE PIPE
 - D) PLUG EXISTING DRAIN PIPE IN SOUTH SUMP WALL AND SOUTH OF SUMP WITH GROUT
- 3 THE CONTRACTOR WILL RESTORE THE FINAL GRADE AROUND THE SUMP TO ITS ORIGINAL GRADE, EXCEPT THAT A MINIMUM OF 2 FEET OF COVER WILL BE PLACED DIRECTLY OVER THE SUMP A STEEL FENCE POST PAINTED ORANGE WILL BE PLACED OVER THE CENTER OF THE SUMP TO MARK ITS LOCATION



DETAIL 1
BUILDING 881 FOUNDATION DRAIN SUMP

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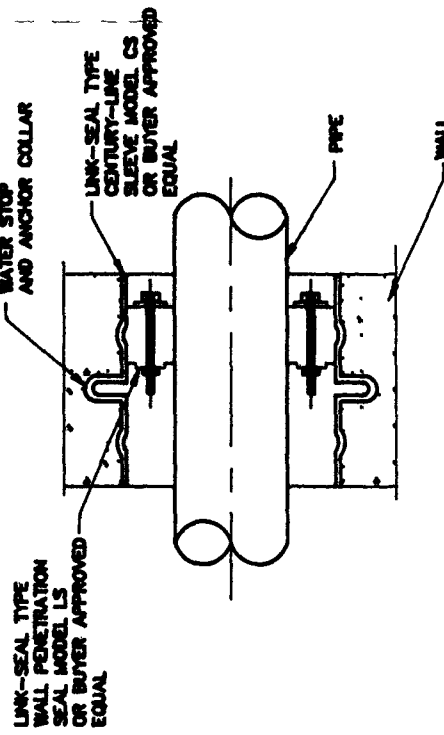


NOTE.

- 1) SEAT ANGLES AND ANCHORS SHALL BE CONSTRUCTED OF STEEL ACCORDING TO THE SPECIFICATIONS.**

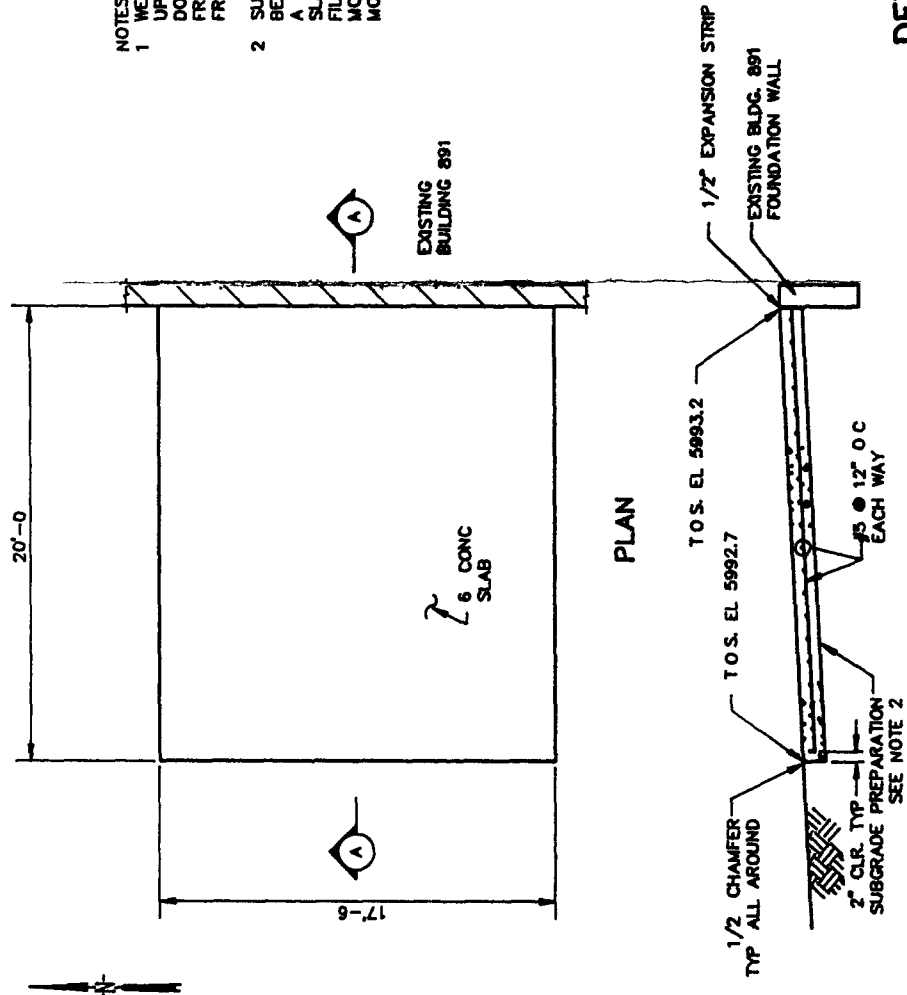
DETAIL 2
STEEL PLATE SEAT ANGLE

30340-311



DETAIL 3 CONCRETE WALL PIPE PENETRATION

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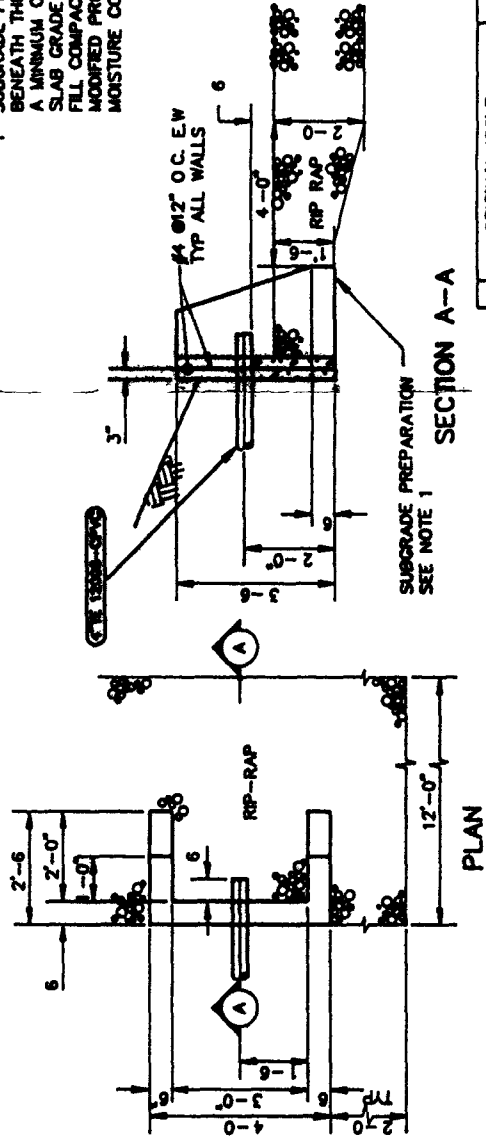


DETAIL 4
DOOR APRON-PLAN AND SECTION

38642-309

NOTE

- 1 SUBGRADE PREPARATION—THE SURFACE BENEATH THE SLAB SHALL BE OVEREXCAVATED TO A MINIMUM OF TWO FEET AND REFILLED TO SLAB GRADE WITH CLASS 1 STRUCTURAL FILL COMPACTED TO A MINIMUM OF 90% MODIFIED PROCTOR DENSITY AT OPTIMUM MOISTURE CONTENT



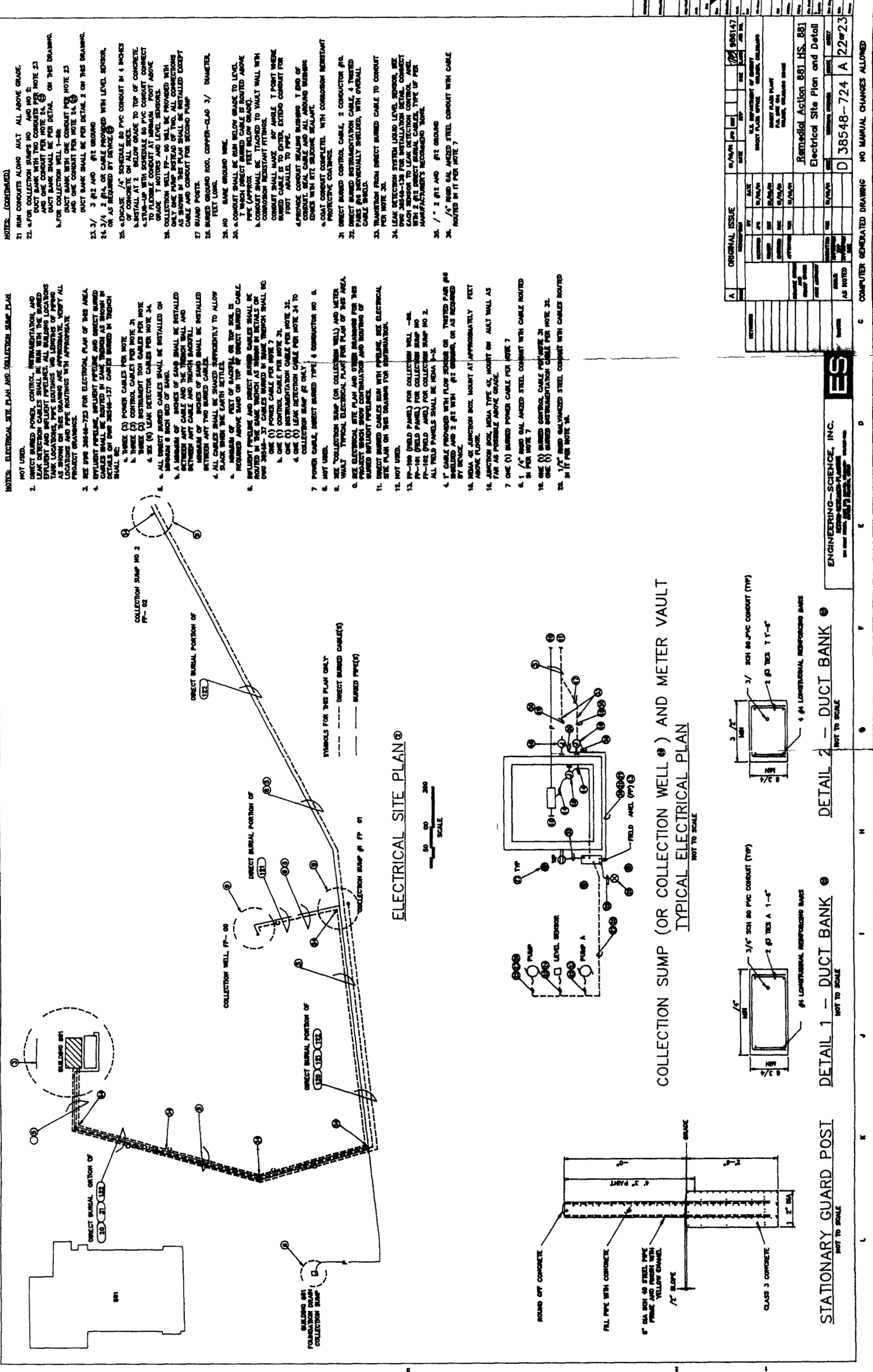
DETAIL 5 DISCHARGE STRUCTURE

38548-133

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ENGINEERING-CONCRETE
DESIGN-BUILDING PLANS
 240 EAST 57TH, 10TH FLOOR, NEW YORK, N.Y. 10022-3801

COMPUTER GENERATED DRAWING NO MANUAL CHANGES ALLOWED



- NOTES: ELECTRICAL SITE PLAN AND COLLECTION SUMP PLAN
- NOT USED.
2. DIRECT BURIED POWER, CONTROL, INSTRUMENTATION, AND LEAK DETECTION CABLES SHALL BE RUN WITH THE BURIED EFFLUENT AND INFLUENT PIPES. ALL BUILDING LOCATIONS, TANK LOCATIONS, PIPE ROUTINGS, AND LENGTHS OF PIPING AS SHOWN ON THIS DRAWING ARE APPROXIMATE. VERIFY ALL LOCATIONS AND PIPE ROUTINGS WITH APPROPRIATE PROJECT DRAWINGS.
3. SEE DWG 38548-723 FOR ELECTRICAL PLAN OF THIS AREA.
4. EFFLUENT PIPELINE, INFLUENT PIPELINE AND DIRECT BURIED CABLES SHALL BE ROUTED IN SAME TRENCH AS SHOWN IN DETAILS ON DWG 38548-137. CABLES BURIED IN TRENCH SHALL BE:
- a. THREE (3) POWER CABLES PER NOTE 31
 - b. THREE (3) CONTROL CABLES PER NOTE 31
 - c. THREE (3) INSTRUMENTATION CABLES PER NOTE 34
 - d. SIX (6) LEAK DETECTION CABLES PER NOTE 34
5. ALL DIRECT BURIED CABLES SHALL BE INSTALLED ON MINIMUM 6 INCH BED OF SAND.
6. A MINIMUM OF 12 INCHES OF SAND SHALL BE INSTALLED BETWEEN ANY CABLE AND THE TRENCH WALL AND MINIMUM OF 12 INCHES OF SAND SHALL BE INSTALLED BETWEEN ANY TWO BURIED CABLES.
7. ALL CABLES SHALL BE SHAKED SUFFICIENTLY TO ALLOW SLACK WHEN THE EARTH SETTLES.
8. MINIMUM OF FEET OF BACKFILL OR TOP SOIL IS REQUIRED ABOVE SAND ON TOP OF DIRECT BURIED CABLE.
9. INFLUENT PIPELINE AND DIRECT BURIED CABLES SHALL BE ROUTED IN THE SAME TRENCH AS SHOWN IN DETAILS ON DWG 38548-137. CABLES BURIED IN SAME TRENCH SHALL BE:
- a. ONE (1) POWER CABLE PER NOTE 7
 - b. ONE (1) CONTROL CABLE PER NOTE 31
 - c. ONE (1) INSTRUMENTATION CABLE PER NOTE 34
 - d. ONE (1) LEAK DETECTION CABLE PER NOTE 34
10. POWER CABLE, DIRECT BURIED TYPE 4 CONDUCTOR NO. 0.
11. NOT USED.
12. SEE "COLLECTION SUMP (OR COLLECTION WELL) AND METER VAULT" TYPICAL ELECTRICAL PLAN FOR PLAN OF THIS AREA.
13. SEE ELECTRICAL SITE PLAN AND OTHER DRAWINGS FOR THIS PROJECT WHICH SHOW CONTINUATION AND ROUTING OF BURIED INFLUENT PIPES.
14. DIRECT BURIED CABLES RUN WITH PIPELINE. SEE ELECTRICAL SITE PLAN ON THIS DRAWING FOR DETERMINATION.
15. NOT USED.
16. PP-100 (FIELD PANEL) FOR COLLECTION WELL -40.
17. PP-101 (FIELD PANEL) FOR COLLECTION SUMP NO. 00.
18. PP-102 (FIELD PANEL) FOR COLLECTION SUMP NO. 2.
19. ALL FIELD PANELS SHALL BE NEMA 3-B.
20. CABLE PROVIDED WITH FLOW SENSOR OR TRENCH PIR #40 SHOWN AND 2 #12 WITH #12 GROUND, OR AS REQUIRED BY DEVICE.
21. MEDIA AT JUNCTION BOX MOUNT AT APPROXIMATELY FEET ABOVE FLOOR.
22. JUNCTION BOX, MEDIA TYPE 4X, MOUNT ON WALL AS FAR AS POSSIBLE ABOVE GRADE.
23. ONE (1) BURIED POWER CABLE PER NOTE 7
24. 1. 1/2" RIGID GALV ANKED STEEL CONDUIT WITH CABLE ROUTED IN PER NOTE 7
25. ONE (1) BURIED CONTROL CABLE PER NOTE 31
26. ONE (1) BURIED INSTRUMENTATION CABLE PER NOTE 32
27. 1/2" RIGID GALV ANKED STEEL CONDUIT WITH CABLES ROUTED IN IT PER NOTE 16.
28. RUN CONDUITS ALONG AULT ALL ABOVE GRADE.
29. DUCT BANK WITH TWO CONDUITS PER NOTE 23
30. DUCT BANK SHALL BE PER DETAIL 1 ON THIS DRAWING.
31. FOR COLLECTION WELL 1-40
32. DUCT BANK WITH ONE CONDUIT PER NOTE 23
33. AND ONE CONDUIT PER NOTE 34
34. DUCT BANK SHALL BE PER DETAIL 2 ON THIS DRAWING.
35. 3/4" 2 #12 AND #12 GROUND
36. 1/2" RIGID GALV ANKED STEEL CONDUIT WITH CABLE ROUTED IN IT PER NOTE 7

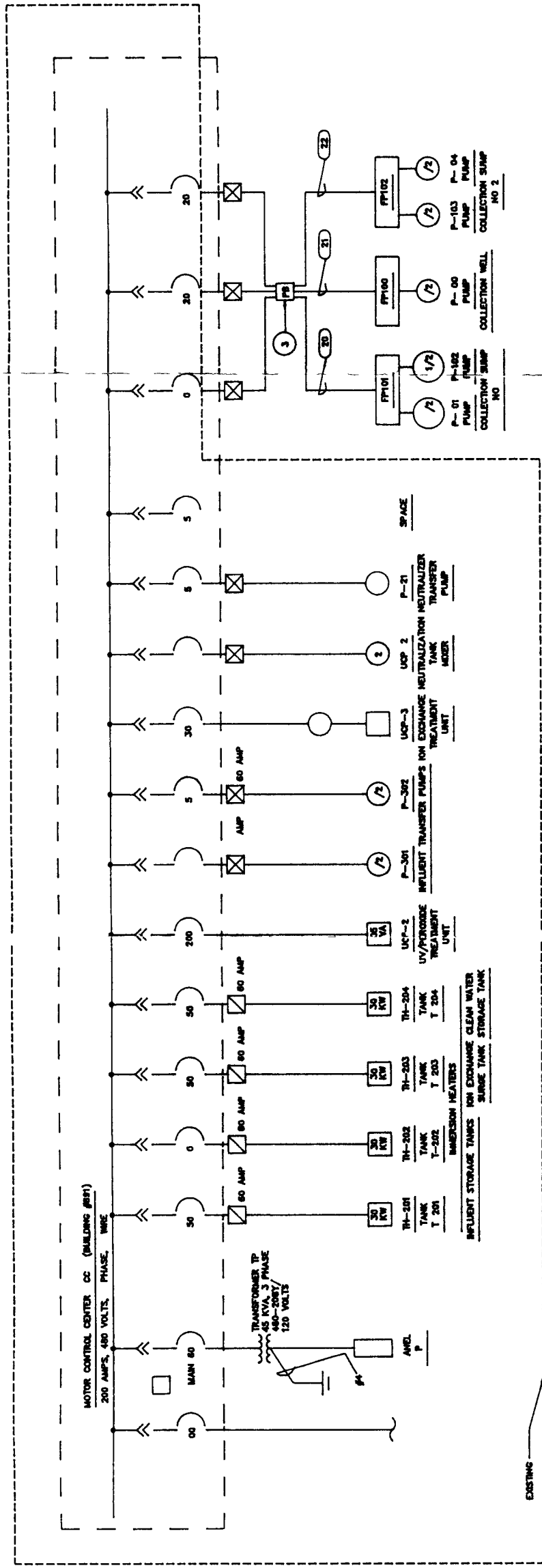
COLLECTION SUMP (OR COLLECTION WELL) AND METER VAULT
TYPICAL ELECTRICAL PLAN
NOT TO SCALE

DETAIL 1 - DUCT BANK
NOT TO SCALE

DETAIL 2 - DUCT BANK
NOT TO SCALE

STATIONARY GUARD POST
NOT TO SCALE

ENGINEERING-SCIENCE, INC.
2000-2001-2002-2003-2004-2005-2006-2007-2008-2009-2010-2011-2012-2013-2014-2015-2016-2017-2018-2019-2020-2021-2022-2023-2024-2025-2026-2027-2028-2029-2030-2031-2032-2033-2034-2035-2036-2037-2038-2039-2040-2041-2042-2043-2044-2045-2046-2047-2048-2049-2050-2051-2052-2053-2054-2055-2056-2057-2058-2059-2060-2061-2062-2063-2064-2065-2066-2067-2068-2069-2070-2071-2072-2073-2074-2075-2076-2077-2078-2079-2080-2081-2082-2083-2084-2085-2086-2087-2088-2089-2090-2091-2092-2093-2094-2095-2096-2097-2098-2099-2100-2101-2102-2103-2104-2105-2106-2107-2108-2109-2110-2111-2112-2113-2114-2115-2116-2117-2118-2119-2120-2121-2122-2123-2124-2125-2126-2127-2128-2129-2130-2131-2132-2133-2134-2135-2136-2137-2138-2139-2140-2141-2142-2143-2144-2145-2146-2147-2148-2149-2150-2151-2152-2153-2154-2155-2156-2157-2158-2159-2160-2161-2162-2163-2164-2165-2166-2167-2168-2169-2170-2171-2172-2173-2174-2175-2176-2177-2178-2179-2180-2181-2182-2183-2184-2185-2186-2187-2188-2189-2190-2191-2192-2193-2194-2195-2196-2197-2198-2199-2200-2201-2202-2203-2204-2205-2206-2207-2208-2209-2210-2211-2212-2213-2214-2215-2216-2217-2218-2219-2220-2221-2222-2223-2224-2225-2226-2227-2228-2229-2230-2231-2232-2233-2234-2235-2236-2237-2238-2239-2240-2241-2242-2243-2244-2245-2246-2247-2248-2249-2250-2251-2252-2253-2254-2255-2256-2257-2258-2259-2260-2261-2262-2263-2264-2265-2266-2267-2268-2269-2270-2271-2272-2273-2274-2275-2276-2277-2278-2279-2280-2281-2282-2283-2284-2285-2286-2287-2288-2289-2290-2291-2292-2293-2294-2295-2296-2297-2298-2299-2300-2301-2302-2303-2304-2305-2306-2307-2308-2309-2310-2311-2312-2313-2314-2315-2316-2317-2318-2319-2320-2321-2322-2323-2324-2325-2326-2327-2328-2329-2330-2331-2332-2333-2334-2335-2336-2337-2338-2339-2340-2341-2342-2343-2344-2345-2346-2347-2348-2349-2350-2351-2352-2353-2354-2355-2356-2357-2358-2359-2360-2361-2362-2363-2364-2365-2366-2367-2368-2369-2370-2371-2372-2373-2374-2375-2376-2377-2378-2379-2380-2381-2382-2383-2384-2385-2386-2387-2388-2389-2390-2391-2392-2393-2394-2395-2396-2397-2398-2399-2400-2401-2402-2403-2404-2405-2406-2407-2408-2409-2410-2411-2412-2413-2414-2415-2416-2417-2418-2419-2420-2421-2422-2423-2424-2425-2426-2427-2428-2429-2430-2431-2432-2433-2434-2435-2436-2437-2438-2439-2440-2441-2442-2443-2444-2445-2446-2447-2448-2449-2450-2451-2452-2453-2454-2455-2456-2457-2458-2459-2460-2461-2462-2463-2464-2465-2466-2467-2468-2469-2470-2471-2472-2473-2474-2475-2476-2477-2478-2479-2480-2481-2482-2483-2484-2485-2486-2487-2488-2489-2490-2491-2492-2493-2494-2495-2496-2497-2498-2499-2500-2501-2502-2503-2504-2505-2506-2507-2508-2509-2510-2511-2512-2513-2514-2515-2516-2517-2518-2519-2520-2521-2522-2523-2524-2525-2526-2527-2528-2529-2530-2531-2532-2533-2534-2535-2536-2537-2538-2539-2540-2541-2542-2543-2544-2545-2546-2547-2548-2549-2550-2551-2552-2553-2554-2555-2556-2557-2558-2559-2560-2561-2562-2563-2564-2565-2566-2567-2568-2569-2570-2571-2572-2573-2574-2575-2576-2577-2578-2579-2580-2581-2582-2583-2584-2585-2586-2587-2588-2589-2590-2591-2592-2593-2594-2595-2596-2597-2598-2599-2600-2601-2602-2603-2604-2605-2606-2607-2608-2609-2610-2611-2612-2613-2614-2615-2616-2617-2618-2619-2620-2621-2622-2623-2624-2625-2626-2627-2628-2629-2630-2631-2632-2633-2634-2635-2636-2637-2638-2639-2640-2641-2642-2643-2644-2645-2646-2647-2648-2649-2650-2651-2652-2653-2654-2655-2656-2657-2658-2659-2660-2661-2662-2663-2664-2665-2666-2667-2668-2669-2670-2671-2672-2673-2674-2675-2676-2677-2678-2679-2680-2681-2682-2683-2684-2685-2686-2687-2688-2689-2690-2691-2692-2693-2694-2695-2696-2697-2698-2699-2700-2701-2702-2703-2704-2705-2706-2707-2708-2709-2710-2711-2712-2713-2714-2715-2716-2717-2718-2719-2720-2721-2722-2723-2724-2725-2726-2727-2728-2729-2730-2731-2732-2733-2734-2735-2736-2737-2738-2739-2740-2741-2742-2743-2744-2745-2746-2747-2748-2749-2750-2751-2752-2753-2754-2755-2756-2757-2758-2759-2760-2761-2762-2763-2764-2765-2766-2767-2768-2769-2770-2771-2772-2773-2774-2775-2776-2777-2778-2779-2780-2781-2782-2783-2784-2785-2786-2787-2788-2789-2790-2791-2792-2793-2794-2795-2796-2797-2798-2799-2800-2801-2802-2803-2804-2805-2806-2807-2808-2809-2810-2811-2812-2813-2814-2815-2816-2817-2818-2819-2820-2821-2822-2823-2824-2825-2826-2827-2828-2829-2830-2831-2832-2833-2834-2835-2836-2837-2838-2839-2840-2841-2842-2843-2844-2845-2846-2847-2848-2849-2850-2851-2852-2853-2854-2855-2856-2857-2858-2859-2860-2861-2862-2863-2864-2865-2866-2867-2868-2869-2870-2871-2872-2873-2874-2875-2876-2877-2878-2879-2880-2881-2882-2883-2884-2885-2886-2887-2888-2889-2890-2891-2892-2893-2894-2895-2896-2897-2898-2899-2900-2901-2902-2903-2904-2905-2906-2907-2908-2909-2910-2911-2912-2913-2914-2915-2916-2917-2918-2919-2920-2921-2922-2923-2924-2925-2926-2927-2928-2929-2930-2931-2932-2933-2934-2935-2936-2937-2938-2939-2940-2941-2942-2943-2944-2945-2946-2947-2948-2949-2950-2951-2952-2953-2954-2955-2956-2957-2958-2959-2960-2961-2962-2963-2964-2965-2966-2967-2968-2969-2970-2971-2972-2973-2974-2975-2976-2977-2978-2979-2980-2981-2982-2983-2984-2985-2986-2987-2988-2989-2990-2991-2992-2993-2994-2995-2996-2997-2998-2999-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[illegible]

NOTES

- ONE (1) DIRECT BURIAL TYPE POWER CABLE CONDUCTION NO 10.
- CABLE IS ROUTED IN CONDUIT FOR PART OF RUN ONLY AS SHOWN ON DWG NO 38546- 24 ELECTRICAL SITE PLAN.
- PULL BOX OUTSIDE OF BUILDING 887. SEE DETAILS P/ AND 2, DWG NO 38546-723.
- SEE DWG NO 38546- 24 FOR INFORMATION ON CONTROL AND INSTRUMENT ROOM WIRING.

[illegible]

ENGINEERING—SCIENCE INC
800-255-2555

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| C | COMPUTER GENERATED DRAWING | NO MANUAL CHANGES ALLOWED |
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